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DEPARTMENT OF AGRICULTURE, FEDERATION OF MALAYA.

Kuala Lumpur.

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THE

Malayan Agricultural Journal

OCTOBER, 1952.

EDITORIAL

The Use of Fertilisers on Padi Land.

The Department of Agriculture has for some years been conducting experiments, throughout the Federation, on the use of fertilisers with padi.

Experiments on the Department's padi stations in Kelantan have shown that substantial increases in yields of both wet and dry padi could be obtained by the use of artificial fertilisers, and the experimental work was sufficiently advanced in the 1951-52 season for trials to be carried out by smallholders on their own land and under the supervision of officers of the Department. Some 260 trials were laid down and are described in the article by Mr. Ashby which follows.

It was unfortunate that in this particular season the trials were so affected by drought, and yields from control plots were very much below normal, but the results have shown that an application of 200 lbs. of a standard mixture of artificial fertilisers produces an increase in yield of about 100 gantangs (560 lbs.) of padi per acre.

The cost of 200 lbs. of the fertiliser ex-godown is $32, and it is estimated that the return per acre to the cultivator, at the current local price of padi, is in the region of $65.

The standard fertiliser mixture is being recommended for general use by all padi cultivators in Kelantan in the 1952-53 season, and the Federal Government has granted a subsidy which reduces the cost of the fertiliser to the cultivator by 50 per cent.

The results obtained in Kelantan have also been shown to be applicable in the neighbouring State of Trengganu where conditions are largely similar, and it is estimated that use of the fertiliser by cultivators in both States would increase rice production by about 30,000 tons per annum.

Pepper Cultivation in Sarawak.

This issue of the Journal contains a digest of an instructive booklet on the cultivation and marketing of pepper in Sarawak. The booklet was written by Mr. H. Sandford, Agricultural Officer, Department of Agriculture, Sarawak, and the digest is published by courtesy of the Director of Agriculture, Sarawak.

There are many areas in Malaya having similar conditions of climate and soil to those in the pepper-growing areas of Sarawak and it is hoped that the information contained in the digest will be of value to agriculturists who are considering cultivating the pepper vine.

Introduced Insect Pests. Mr. Lever's notes, in this issue of the Journal, on some new or recently introduced insect pests in Singapore serve as a further reminder of the danger in these days of rapid transport of persons or freight from one side of the world to the other, of the introduction of pests and diseases that could affect very seriously Malaya's economy. These notes warn us that our phyto-sanitary precautions must be forceful and that the cooperation of members of the public is essential if such precautions are to be successfully carried out.

PADI MANURIAL TRIALS ON SMALLHOLDERS' LAND IN KELANTAN, SEASON 1951-52

BY

H. K. ASHBY,

State Agricultural Officer, Kelantan.

Introduction.

During the last few years, evidence had been obtained from experiments carried out by the Department of Agriculture on its own Padi Stations and Test Plots that substantial increases in the yields of both wet and dry padi could be brought about by the use of artificial manures. Similar increases in yield had also been observed in occasional small-scale trials which had been carried out on smallholders' land during the course of study in the field of partial or complete crop failure.

The immediate need in Kelantan, as in other States in the Federation, was for a manure which would increase the yields of padi at an economic cost, and by the end of the 1950-51 season it was evident that such a manure had been found. The components of this manure were sulphate of ammonia, superphosphate, and muriate of potash, in such proportions, chosen rather arbitrarily, as to supply 47 lbs. nitrogen, 40 lbs. P_2O_5, and 50 lbs. K_2O per acre. On this basis it was decided that further field trials should be carried out.

It remained to be seen whether the results obtained on Departmental land would recur on smallholders' land, and to this end field trials were conducted over a wide range of soil types under smallholders' conditions. In the event of these manurial trials being successful, the smallholders would be given the opportunity of seeing satisfactory increases in yield on their own land, and an introduction would be made towards further extension work by members of the Department of Agriculture, while the mixture could be recommended by the Department for general use in Kelantan as an interim measure. Later it was hoped that a new series of experiments would indicate the composition of a cheaper and more efficient manurial mixture which would in time supplant the temporary standard mixture.

The account which follows describes the planning, execution, and results of these trials.

Planning of the Trials.

The practicable number of trials was limited by three factors. A number of officers were already tied to Experiment Stations or Padi Test Plots as a whole time, or nearly whole time, occupation during the padi season. Secondly, there were the problems of transport of manure, of which about 15 tons had to be delivered when and where it was needed

with the aid of one 15 cwt. truck and one jeep and trailer. Thirdly, some areas in Kelantan are served neither by road nor railway, and where roads exist they may be impassable during the monsoon.

It would have been desirable to have arranged a random distribution of the trials throughout all the padi growing areas in Kelantan, but the limitations mentioned above ruled this out. On account of the difficulty of taking vehicles across the Kelantan river, and the time involved, it was necessary to place a low limit on the number of trials that could be undertaken on the west side of the river, and the trials therefore tended to be laid down on the east side of the river within easy reach of an all-weather road. Proximity to a road was advantageous in that passers-by could frequently see the progress of the trials.

Having regard to the man-power available for the task, and road and rail transport facilities, it was decided to attempt to undertake 325 trials. Certain officers of the Department had more than one District to cover, and the basis of estimation for the number of trials was that one man with a substantial amount of time to devote to field work in the District might be expected to supervise 50 trials, and that others who had the running of Padi Test Plots to attend to in addition might be expected to supervise 25 trials. Events showed that this estimate was rather too high, 259 trials being laid down, or 80 per cent. of the number aimed at.

A matter which has a bearing on the number of trials which can be laid down is the period of time during which padi planting is in progress, for were everyone to plant their padi on the same day it would be impossible to provide skilled supervision for more than a few. In Kelantan, padi planting is spread over 4½ months, commencing with early wet padi in July and followed successively with dry padi, long term wet padi, medium term wet padi, and finally short term wet padi. It was the intention that the trials should cover all these types of padi, not only on account of the different growing conditions but also because it afforded the means of spreading the work over a greater period of time.

It was considered essential that the manured area under any one treatment should be large enough to be impressive and to catch the eye of the passer-by. The plot size was therefore fixed at a whole field of about 1 sq. chain in area, and manured land within sight of a road was easily recognisable by persons travelling along it.

Four adjacent fields were required for each trial, but it was not always possible for all of them to be in the ownership of one man. No restriction was placed on the variety of padi which might be planted, but it was essential to try to arrange that all four fields should be planted with the same variety from a common nursery, and where necessary to arrange with one of the owners to supply all the seedlings required. Of these four fields, only three were going to be manured, and where there was more than one landowner it was arranged that the man who owned the un-manured field should also own one or more of the manured fields. This precaution was thought to be necessary to discourage the unwanted

illicit manuring of the Control plot with such materials as cattle manure or wood ash.

It was decided to exclude from the trials all the land occupied under systems of tenancy which were based on share cropping, as the tenant in such cases is unlikely to be interested. Landowners were on the whole very willing and ready to put up with the inconvenience of a manurial trial on their land, and in only one District were there prevalent signs of apathy.

It will be seen therefore that the distribution of the trials throughout Kelantan was far from being a random one, but it did cover as wide a range of conditions as was practicable.

The manurial mixture under test in these trials had formerly been successfully used at an application rate of 400 lbs. per acre, costing about $60. This was considered to be the maximum amount which any smallholder was likely to spend on manure, and the rate was therefore not exceeded.

The treatments used in the trials were:

A = 200 lbs. manure per acre, applied shortly before planting.

B = 200 lbs. manure per acre, applied shortly before planting plus 200 lbs. manure per acre applied 6 to 8 weeks after planting.

C = Control. No manure.

D = 200 lbs. manure per acre, applied 6 to 8 weeks after planting.

The rates and times of application applied equally to both wet and dry padi, but the method of application of the manure was different and determined by previous experiments. In the case of dry padi, the first application of manure was to the surface of the dry ground and lightly harrowed in before planting, and the second was worked into the ground with a hoe whilst weeding.

In the case of wet padi, experiments had shown the desirability of placing the manure below the surface of the mud. All water was run off the surface of the ground, and manure was broadcast over the surface of the mud, and thoroughly harrowed in, after which the seedlings were transplanted. In the second application, all water was again run off the field and the manure was this time inserted into footprints in the mud which were then covered over, and water was then again allowed to flow on to the field.

Execution of the Trials.

Sites for each trial were selected by the field staff after discussion with the landowners, and data regarding each site were recorded in duplicate as below:

(i) District Trial No.
(ii) Daerah.
(iii) Mukim.
(iv) Sketch plan of Lots and Layout.
(v) Landowners names and acres of Lots.

(vi) Variety of padi to be planted.
(vii) Approximate dates of issue of manure.
(viii) Soil type.
(ix) Centre for distribution of manure.
(x) Yields of padi at harvest from sample plots of not less than 22 x 22 ft.

Additional notes were made during the course of the season on the progress of the trial, attention being paid to any visible differences between the growth of padi on the different plots, water supply, pest attack etc., and a careful watch was kept for signs of any events which might throw doubt upon the accuracy of the trial, e.g. the illicit manuring of Control plots etc.

During the planning of these trials, it was realised that plot sizes could either be standardised at a certain fraction of an area, or that they could be variable in accordance with the size of the Lot, and it was the latter arrangement that was adopted. The practical difficulty which this introduced was that the manurial dressings for each Lot had to be calculated and measured individually. The method adopted was to determine the area of the Lot by reference to the Title, or more commonly by direct measurement in the field, and then refer to a Table which had been prepared to show the manurial dressing appropriate to plots between the sizes of 0.8 and 1.5 sq. chains in area. On account of the difficulty of transporting small weighing machines without damage or derangement, the manurial dressings were measured volumetrically in gantangs (gallons) and cigarette tins (half pints). The Table provided an interval of 0.025 sq. chain between plot areas which conveniently corresponded to a difference of one cigarette tin in the volume of manure required for a 200 lbs. per acre dressing of manure.

Ideally, the manure for any one dressing should always have been measured by the officer in charge of the trial and immediately applied to the land under his supervision, and this indeed was generally done. There were however some landowners who wished that the manure for the second application in treatment "B" should be left ready in their houses for use later on. Compliance with this request was in some cases a convenience, but in others it lead to abuse, the manure being used for purposes other than those intended.

The amount of work and planning necessary for the undertaking of a large number of scattered trials on smallholders' land is not to be underestimated, and attention has been drawn to some of the more important matters affecting the manner in which the trials were carried out. The most important unpredictable factor was the weather. The 1951-52 season while excellent for the planting of dry padi was bad for wet padi. Drought was universal throughout the wet padi planting season, but some Districts such as Kota Bharu, Pasir Mas and Tumpat were more seriously affected. Within each District there were striking differences; in some cases wet padi could not be planted at all, while adjacent areas were able

to grow a crop. Bachok, Pasir Puteh and Machang were on the whole less severely affected.

The shortage of water greatly delayed the preparation of the land, and the use of over-age nursery seedlings was widespread. It became most difficult if not impossible to predict when any land would be in fit condition to manure and plant. In areas served by efficient irrigation, this trouble would not be encountered, but in areas solely dependent upon rainfall it is one to be expected from time to time. The effect that this dry season may have had on the uptake of manure and its utilisation by the padi plants is not known, but the general yield level of unmanured control plots was low.

Supervision of manurial trials such as these calls for more time and travelling than would padi variety trials of a comparable nature, and when the crop is ripening great care has to be exercised lest the harvesting of the plots be undertaken by the landowner in the absence of the supervising officer.

Yields of padi were estimated at harvest by measuring out a single random plot of 22 x 22 ft. = 1/90th acre per field, the landowner then cutting, threshing, and winnowing the crop in the presence of the supervising officer, who measured the volume in *chupak* (quarts) and cigarette tins (half pints) to the nearest cigarette tin. As the grain had not been fully dried out at the time of measuring, the yield estimates may all be rather too high.

Results of the Trials.

A. Wet Padi Trials.

Table I shows the number and distribution of the trials by Districts. The column showing the number of partial failures or unreliable trials requires some explanation. A trial was assessed as being a partial failure in any instance where there had been any one or more of the following: total loss of crop on one plot; heavy pest damage; Control plot exclusively, or any two manured plots, without water for the whole season; more than one variety of padi planted; known manuring of the control plot; known errors in the rate of application of manure. The data from such trials were excluded from the statistical analysis.

Table I.

Number and Distribution of Wet Padi Trials.

District.	Laid down.	Planted.	Completed.	Partial failure.	Total failure.
Kota Bharu	58	54	45	8	1
Pasir Mas	35	35	22	13	—
Tumpat	23	22	17	2	3
Bachok	14	14	13	1	—
Pasir Puteh	40	40	26	13	1
Machang	63	63	50	13	—
Total	233	228	173	50	5

The 228 wet padi trials which were actually planted covered the wide range of 72 varieties of padi. The 13 varieties most commonly planted in these trials appeared in 135 trials, the frequency being given in Table II, and the remaining 59 other varieties occurred in the balance of 93 trials.

Table II.

Frequency of Wet Padi Varieties.

No. of trials.	Variety.	Type.
21	Anak Ikan (all types).	Short to Medium term.
17	Mayang Sagumpal.	Long term.
16	Jintan Pa' Mat.	Medium term.
12	Anak Naga.	Medium term.
12	Nalong.	Long term.
9	Anak Gajah.	Medium term.
9	Anak Puteh.	Medium term.
9	Kedah.	Medium term.
7	Mayang Kuning.	Long term.
6	Arohan.	Long term.
6	Mayang Batil.	Medium term.
6	Ranggon.	Medium term.
5	Morak Sepilai.	Long term.
135	13 varieties.	
93	59 other varieties.	
Total 228 trials.	72 varieties.	

The soil types on which these trials were conducted are shown in Table III, the figures given being those for trials actually planted.

Table III.

Distribution of Wet Padi Trials by Districts and Soil Types.

Soil Type No.	Soil Type.	District.						Total.
		Kota Bharu.	Pasir Mas.	Tumpat.	Bachok.	Pasir Puteh.	Machang.	
1	Deficiency Area -	—	1	—	—	—	—	1
2	Coastal Sand (Shallow) -	2	—	1	8	—	—	11
3	Coastal Sand (Deep) -	—	—	4	—	—	—	4
4	Poor Sandy Soil including Granite Wash -	7	—	—	2	33	43	85
5	Light Clay Loam -	2	3	2	—	—	—	7
6	Medium Clay Loam	43	16	9	4	2	19	93
7	Heavy Clay -	—	15	—	—	—	1	16
8	White Clay -	—	—	2	—	5	—	7
9	Peaty (Shallow) -	—	—	3	—	—	—	3
10	Peaty (Deep) -	—	—	1	—	—	—	1
	Total Planted -	54	35	22	14	40	63	228

YIELD DATA CLASSIFIED BY DISTRICTS AND SOIL GROUPS.

The immediate need was for officers engaged on extension work in the field to be provided with information on the results of their local trials. Data were therefore analysed by Districts, and as far as possible by the major soil groups within each District. In three Districts, for example, a small number of trials covered a wide range of soil conditions, and the reliable data were therefore analysed as a whole. In other Districts, data from reliable trials were grouped around the lighter and heavier soils of the District. The actual groupings of the soil types numbered in Table III for the purpose of analysis of District data were as follows:

Kota Bharu.	Lighter soils.	Soil types 2, 4, and 5.
	Heavier soils.	Soil type 6.
Pasir Mas.		All soil types.
Tumpat.		All soil types.
Bachok.	Lighter soils.	Soil type 2.
	Heavier soils.	Soil types 4 and 6.
Pasir Puteh.	Lighter soils.	Soil type 4.
	Heavier soils.	Soil types 6 and 8.
Machang.		All soil types.

Data were analysed as in a Randomised Block experiment.

(1) KOTA BHARU DISTRICT.

Wet padi in Kota Bharu District was seriously affected by lack of rainfall throughout most of the planting and growing season, and overage seedlings were commonly used. Grain setting was poor, and there were many empty ears at harvest.

Yield Data for Lighter Soils.

The Analysis of Variance for seven trials showed that the differences in yield between treatments were easily significant at the 1 per cent. point of probability. A summary of mean yields is given in Table IV.

Table IV.

Wet Padi Trials on Lighter Soils in the Kota Bharu District.

Summary of Mean Yields.

	Treatment.				General Mean.	* M.S.D.	
	A.	B.	C.	D.		5 per cent point.	1 per cent point.
Gantangs per acre. -	307.9	390.9	125.4	231.7	264.0	104.9	143.7
Percentage General Mean. - -	116.6	148.0	47.5	87.8	100.0	39.7	54.4
Percentage Control.	245.4	311.6	100.0	184.7	—	—	—

* M.S.D. = Minimum Significant Difference.

The conclusions drawn from this series of trials were:

(i) All manurial treatments significantly outyielded the unmanured Control, significance being attained at the 1 per cent. point in the case of Treatments "A" and "B", and at the 5 per cent. point in the case of Treatment "D".

(ii) The double manurial dressing "B" outyielded the single late dressing "D" at the 1 per cent. point of significance.

(iii) There was no significant difference between "A" and "B" or "A" and "D".

Yield Data for Heavier Soils.

The 38 trials comprised in this group showed on analysis that the differences between treatment yields were easily significant at the 1 per cent. point of probability. A summary of mean yields is given in Table V.

Table V.

Wet Padi Trials on Heavier Soils in the Kota Bharu District.

Summary of Mean Yields.

	Treatment.				General Mean.	M.S.D.	
	A.	B.	C.	D.		5 per cent point.	1 per cent point.
Gantangs per acre. -	304.8	381.7	201.9	298.0	294.7	39.7	51.9
Percentage General Mean. - -	103.4	129.5	68.5	101.1	100.0	13.5	17.6
Percentage Control.	151.0	189.1	100.0	147.5	—	—	—

The conclusions from these trials were:

(i) All manurial treatments outyielded the unmanured Control at the 1 per cent. point of significance.

(ii) The double manurial dressing "B" outyielded, at the 1 per cent. point of probability, both the single dressings "A" and "D".

(iii) There was no significant difference between the yields of the two single dressing treatments "A" and "D".

(2) Pasir Mas District.

As in Kota Bharu District, late planting of over-age seedlings, drought, a poor set of grain, and in a few cases pests, affected yields generally, and very rarely did any trial escape these troubles.

Yield Data for All Soil Types.

Analysis of variance of the 22 completed trials showed that the differences between treatment yields were easily significant at the 1 per

cent. point of probability. A summary of mean yields is given in Table VI.

Table VI.

Wet Padi Trials on All Soil Types in the Pasir Mas District.
Summary of Mean Yields.

	Treatment.				General Mean.	M.S.D.	
	A.	B.	C.	D.		5 per cent point.	1 per cent point.
Gantangs per acre. -	251.2	310.6	160.8	245.5	242.0	38.9	51.7
Percentage General Mean. - -	103.8	128.3	66.4	101.4	100.0	16.1	21.4
Percentage Control.	156.2	193.2	100.0	152.7	—	—	—

The conclusions from these trials were:

(i) All manurial treatments outyielded the unmanured Control at the 1 per cent. point of significance.

(ii) The double manurial dressing "B" significantly (1 per cent. point) outyielded both the single dressing treatments "A" and "D".

(iii) There was no significant difference between the yields from the two single dressing treatments.

(3) Tumpat District.

Conditions for the growth of the crop were generally unfavourable, as described for Pasir Mas District above.

Yield Data for All Soil Types.

Analysis of yield data from 17 trials showed that treatment differences were easily significant at the 1 per cent. point of probability. A summary of mean yields is given in Table VII.

Table VII.

Wet Padi Trials on All Soil Types in the Tumpat District.
Summary of Mean Yields.

	Treatment.				General Mean.	M.S.D.	
	A.	B.	C.	D.		5 per cent point.	1 per cent point.
Gantangs per acre. -	242.5	266.1	170.2	254.4	233.3	33.9	45.4
Percentage General Mean. - -	104.0	114.1	72.9	109.0	100.0	14.5	19.5
Percentage Control.	142.5	156.4	100.0	149.5	—	—	—

The conclusions from these trials were:

(i) All manurial treatments outyielded Control at the 1 per cent. point.

(ii) There were no significant differences between the yields of the various manurial treatments.

(4) BACHOK DISTRICT.

The trials were to some extent affected by dry weather, but conditions on the whole were fairly good.

Yield Data for Sandy Soils.

Analysis of yield data from eight trials showed that the effects of manure were easily significant at the 1 per cent. point. A summary of mean yields is given in Table VIII.

Table VIII.

Wet Padi Trials on Sandy Soils in the Bachok District.

Summary of Mean Yields.

	Treatment.				General Mean.	M.S.D.	
	A.	B.	C.	D.		5 per cent point.	1 per cent point.
Gantangs per acre. -	282.1	355.5	143.6	236.5	254.4	60.4	82.2
Percentage General Mean. - -	110.9	139.7	56.4	93.0	100.0	23.7	32.3
Percentage Control.	196.5	247.6	100.0	164.7	—	—	—

The conclusions from these trials were:

(i) All manurial treatments significantly outyielded Control at the 1 per cent. point of significance.

(ii) The double dressing "B" significantly outyielded both of the single manurial dressings "A" and "D", the former at the 5 per cent. and the latter at the 1 per cent. point of significance.

(iii) There was no significant difference in yield between "A" and "D".

Yield Data for Clay and Sandy Clay Soils.

There were only five trials in this soil group, but nevertheless analysis of the data showed that the differences were significant at the 1 per cent. point. Mean yields are given in Table IX.

Table IX.

Wet Padi Trials on Clay and Sandy Clay Soils in the Bachok District. Summary of Mean Yields.

	Treatment.				General Mean.	M.S.D.	
	A.	B.	C.	D.		5 per cent point.	1 per cent point.
Gantangs per acre. -	234.6	302.8	123.8	184.6	211.5	65.3	91.5
Percentage General Mean. - -	110.9	143.2	58.5	87.3	100.0	30.9	43.3
Percentage Control.	189.5	244.6	100.0	149.1	—	—	—

The conclusions from these trials were:

(i) Treatments "A" and "B" significantly outyielded Control at the 1 per cent. point.

(ii) Treatment "D" was just not significantly higher yielding than Control.

(iii) Treatment "B" significantly outyielded "D" at the 1 per cent. point.

(5) Pasir Puteh District.

This District fared better than the others in having reasonably constant supplies of water, but rather a high proportion of the trials was rated as a partial failure on account of divergences from the manurial treatments specified as well as pest damage and poor set of grain.

Yield Data for Sandy Clay Soils.

Analysis of the results from 20 trials showed that differences between yields were significant at the 1 per cent. point, mean yields being given in Table X.

Table X.

Wet Padi Trials on Sandy Clay Soils in the Pasir Puteh District. Summary of Mean Yields.

	Treatment.				General Mean.	M.S.D.
	A.	B.	C.	D.		1 per cent. point.
Gantangs per acre. -	285.4	337.9	203.4	260.0	271.7	10.8
Percentage General Mean. - -	105.1	124.4	74.9	95.7	100.0	4.0
Percentage Control.	140.4	166.5	100.0	128.0	—	—

The conclusions from these trials were that the double dressing "B" significantly outyielded the single dressing applied shortly before transplanting ("A"), which in turn significantly outyielded the single dressing applied some weeks after transplanting ("D"), which in turn significantly outyielded Control ("C"), all differences being significant at the 1 per cent. point.

Yield Data for Clay Soils.

There were six trials in this soil group, and analysis showed that the differences were significant at the 1 per cent. point. A summary of mean yields is given in Table XI.

Table XI.

Wet Padi Trials on Clay Soils in the Pasir Puteh District.

Summary of Mean Yields.

	Treatment.				General Mean.	M.S.D.	
	A.	B.	C.	D.		5 per cent point.	1 per cent point.
Gantangs per acre. -	258.0	355.3	188.6	237.5	259.9	54.1	74.8
Percentage General Mean. - -	99.3	136.7	72.6	91.4	100.0	20.8	28.8
Percentage Control.	136.8	188.4	100.0	125.9	—	—	—

The conclusions from these trials were:

(i) The double dressing "B" significantly outyielded any other treatment at the 1 per cent. point.

(ii) There was no significant difference between the single dressing applied shortly before transplanting ("A") and the single dressing applied some weeks after transplanting ("D").

(iii) Treatment "A" significantly outyielded Control ("C") at the 5 per cent. point.

(iv) Treatment "D" just failed to attain a significantly higher yield than Control.

(6) Machang District.

The season was a very dry one. Of the 50 trials that were successfully completed, only 11 were described as not being short of water or dry.

Yield Data for All Soil Types.

Analysis of yield data from the 50 completed trials showed that differences in yield between treatments were significant at the 1 per cent. point. A summary of mean yields is given in Table XII.

Table XII.

Wet Padi Trials on All Soil Types in the Machang District.

Summary of Mean Yields.

	Treatment.				General Mean.	M.S.D.	
	A.	B.	C.	D.		5 per cent point.	1 per cent point.
Gantangs per acre. -	214.5	311.6	154.8	226.4	226.8	14.3	18.9
Percentage General Mean. - -	94.6	137.4	68.2	99.8	100.0	6.3	8.3
Percentage Control.	138.6	201.3	100.0	146.3	—	—	—

The conclusions from these trials were:

(i) All manurial treatments outyielded Control at the 1 per cent. point of significance.

(ii) The double dressing "B" outyielded the two single dressings "A" and "D" at the 1 per cent. point of significance.

(iii) There was no significant difference between the yields of the single dressings of manure.

Yield Data Classified by Soil Types.

Reference to Table III shows that the trials were laid down principally on four soil types, i.e. shallow coastal sand; poor sandy soil including granite wash; medium clay loam; and heavy clay. These soils were numbered in Table III as Types Nos. 2, 4, 6, and 7 respectively.

It might be expected that these soil types would respond to the manure to different extents, as in a normal season the yields from the lighter soils are considerably less than those from the heavier soils. The data from the trials were therefore classified and analysed according to soil types only. Analysis showed that for each soil type treatment differences were significant at the 1 per cent. point. A summary of treatment mean yields is given in Table XIII.

With the exception of the lightest soil, shallow coastal sand, classified as Soil Type No. 2, not only are Control plot yields practically identical, but the response to manure has been closely similar throughout.

In a good season, the average yield of wet padi in Kelantan may be estimated at about 275 gantangs per acre, and it was considered possible that the unexpected uniformity of the data in Table XIII might have been brought about by the general low level of the Control plot yields, so information was sought on the response of the higher yielding soils to manure.

Table XIII.

Wet Padi Trials on Major Soil Types.
Summary of Mean Yields.

Treatment.		Soil Type.			
		2.	4.	6.	7.
A.	Gantangs per acre.	263.3	247.7	256.9	260.7
	Percentage Control.	198.4	142.0	150.9	151.7
B.	Gantangs per acre.	331.0	325.1	329.5	320.8
	Percentage Control.	249.4	186.4	193.6	186.7
C.	Gantangs per acre.	132.7	174.4	170.2	171.8
	Percentage Control.	100.0	100.0	100.0	100.0
D.	Gantangs per acre.	222.8	240.9	258.0	243.9
	Percentage Control.	167.9	138.1	151.6	142.0
M.S.D. in gantangs per acre	5 per cent. point.	55.6	13.6	23.6	51.3
	1 per cent. point.	75.4	18.1	31.2	69.1

Without regard for soil types, trials with Control plots yielding over 275 gantangs padi per acre were grouped together for analysis. There were 19 such trials with Control plot yields ranging from 276 to 585 gantangs per acre. The analysis of variance table showed that differences were easily significant at the 1 per cent. point. A summary of mean yields is given in Table XIV.

Table XIV.

Wet Padi Trials with Control Plot Yields of Over 275 Gantangs Per Acre.
Summary of Mean Yields.

	Treatment.				General Mean.	M.S.D.	
	A.	B.	C.	D.		5 per cent point.	1 per cent point.
Gantangs per acre. -	386.6	458.4	339.3	393.1	394.3	39.5	50.0
Percentage General Mean. - -	98.0	116.3	86.1	99.7	100.0	10.0	12.6
Percentage Control.	113.9	135.1	100.0	115.9	—	—	—

The conclusions to be drawn are that responses to manure are not limited to land which, during the particular season when the trials were conducted, was for one reason or another unusually low yielding.

RETURNS FROM THE USE OF MANURE.

The current prices, as on 1st September, 1952, are $16.20 per picul for padi in the field, and $16 per 100 lb. bag of manure ex-godown Kota Bharu. Assuming that the delivery charges for manure are the same as the transport charges allowed for padi from the field to the mill, i.e. 80 cents per picul, the delivered cost of the manure may be estimated at $16.60 per 100 lb. bag. A 200 lb. dressing of manure delivered in the field is therefore equivalent in cost to the value of 48.79 gantangs padi in the field, or, to take a round figure, 50 gantangs. Table XV shows the increases in yield of padi, expressed as gantangs per acre, following the use of manure on various soil types, for comparison with the outlay in the cost of manure which is also expressed in terms of gantangs of padi. It will be seen in each case that the outlay on purchase of manure is more than covered by the increase in crop. The recent grant by the Federal Government of a subsidy to cover half the cost of this manure has not been taken into account in these calculations, and it converts a satisfactory margin of profit into a handsome one.

Table XV.

Increases in Yields of Wet Padi in Gantangs Per Acre Following Manuring.

Treatment.	Cost of Manure expressed in gantangs of padi.	Increase in yield.			
		Soil Type No. 2	Soil Type No. 4	Soil Type No. 6	Soil Type No. 7
A.	50	130.6	73.3	86.7	88.9
B.	100	198.3	150.7	159.3	149.0
D.	50	90.1	66.5	87.8	72.1

B. DRY PADI TRIALS.

A total of 26 trials were laid down and planted, their distribution being shown in Table XVI.

Fourteen varieties of padi were planted in these trials, the commonest being Jintan Koring (six trials) and Muar Pa' Dok (five trials). The other 12 varieties occurred in the remaining 15 trials.

There was little variation in the type of soil covered by these trials, 23 being on medium clay loam and three on a light sandy clay, and in the analysis of the data, soil types and District boundaries were disregarded.

Table XVI.

Number and Distribution of Dry Padi Trials.

District.	Laid down.	Planted.	Completed.	Partial failure.	Total failure.
Kota Bharu	16	16	11	—	5
Pasir Mas	7	7	6	—	1
Tumpat	3	3	3	—	—
Total	26	26	20	—	6

The season would have been a very good one for dry padi had there not been very high winds and heavy rain at flowering time. Growing conditions were good, but grain setting was commonly poor on manured and other land.

YIELD DATA FOR ALL DISTRICTS AND SOIL TYPES.

Analysis of variance of the 20 trials which were satisfactorily completed showed that treatment differences were very easily significant at the 1 per cent. point of probability. The mean yields are summarised in Table XVII.

Table XVII.

Dry Padi Trials.

Summary of Mean Yields for All Soils.

	Treatment.				General Mean.	M.S.D.	
	A.	B.	C.	D.		5 per cent point.	1 per cent point.
Gantangs per acre. -	236.8	305.0	150.6	237.9	232.4	28.6	38.2
Percentage General Mean. - -	101.9	131.2	64.8	102.4	100.0	12.3	16.4
Percentage Control.	157.2	202.5	100.0	158.0	—	—	—

The conclusions from these trials were:

(i) All manurial treatments significantly outyielded Control at the 1 per cent. point.

(ii) The double dressing "B" significantly outyielded both the single dressing treatments "A" and "D" at the 1 per cent. point.

(iii) There was no significant difference in yield between the two single dressing treatments.

The mean yield for Control is about average for dry padi in a normal season, and there is therefore no reason to doubt that the excellent response to manure would be repeated in any other normal season.

RETURNS FROM THE USE OF MANURE.

The cost of manure has been shown above to be equivalent to about 50 gantangs of padi per dressing of 200 lbs. per acre, while the returns are 86.2 and 87.3 gantangs for the single dressings "A" and "D" respectively. The double dressing "B", equivalent in cost to about 100 gantangs of padi has brought in a return of 154.4 gantangs of padi. These increases in yield are very similar to those obtained with the same manure on wet padi.

Summary and Discussion.

These trials have shown that substantial increases in the yields of both wet and dry padi are possible in Kelantan, at an expenditure on manure which can be more than covered by the increased crop in the first season. It is moreover considered likely that there will also be some increase the following year from the residual effects of the manure.

The manurial mixture under test has shown itself capable of increasing yields over a wide range of soil and water conditions, and it is accordingly being recommended for general use by padi planters throughout the State. Arrangements have been made for the sale of a branded manure, conforming to specification, through commercial channels. More recently a subsidy has been granted by the Federal Government which reduces the price of the manure to the padi planter by one half.

There is a very urgent need throughout the State to increase yields per acre, for although there is no shortage of labour for padi planting there is little additional land which can be brought under cultivation, and such additional land as there is is for the most part also in need of manuring before it can become productive. By the application of the manure used in these trials, it would be possible to increase yields of padi by from 12 to 20 million gantangs per annum from the existing padi land, equivalent to 18 to 30 thousand tons of rice.

Acknowledgements.

Acknowledgement is very gratefully made of the work of the many members of the Department of Agriculture who undertook the execution and recording of these trials.

PEPPER IN SARAWAK

A Digest of a Booklet by Mr. H. Sandford,
Agricultural Officer, Department of Agriculture, Sarawak.

Introduction.

Pepper (*Piper nigrum*) is a large perennial vine which climbs up trees or deadwood supports and clings to them by means of numerous aerial rootlets which arise from each node of the stems. Many hundreds of catkins are produced on each vine and it is from these that the berries containing the pepper corns are obtained.

There are two marketable forms of pepper, namely black and white. Black pepper is prepared by drying the berries (usually unripe ones) in the sun after plucking; berries that have dropped prematurely from the vines are also used. White pepper is prepared from ripe berries that have been soaked in water and washed, in order to remove the pericarp, and then dried in the sun. White pepper usually fetches a much higher price than does black pepper.

Pepper is used extensively in the preserved food industry as a flavouring agent with preservative properties. It is also used in the preparation of medicines and as a table condiment.

There are two varieties of pepper vine. The more common variety has smallish leaves, small berries and a high yield, the other variety having rather bigger and thicker leaves, big berries and lower yield.

Most of the pepper in Sarawak is grown by Chinese gardeners and the methods described in this summary are, for the most part, those used by this community.

Soils.

Although pepper will grow on a great variety of soils, it prefers well-drained alluvium rich in organic matter. It will not thrive on poorly-drained soils. In its natural state the vine grows on decaying leaf-mould formed in forests; however, most of the pepper grown in Sarawak is planted on undulating land the soils of which frequently contain a high proportion of fine clay and in some ways behave as clay soils.

Usual Method of Preparation of the Ground for Planting.

After the trees have been felled, the undergrowth is burnt and stumps and roots of trees are removed. The wood is often used to make burnt earth which, because it improves the texture of the clay, is fairly rich in available potash and has been partially sterilised, has a beneficial effect.

Most of the land in Sarawak which is available for planting with pepper is overgrown with *lalang* and in order to kill this weed, the land is *changkolled* three times with an interval of about one month between cultivations. The first cultivation is carried out before the pepper cuttings

are planted. The subsequent operations are usually carried out between the rows after the cuttings have been planted out.

After the first cultivation the ground is marked out with temporary stakes (generally of bamboo 1 in. in diameter and at least 3 ft. long) in rows 7 to 8 ft. apart with the same distance between the rows. The land is then ready for planting out.

Propagation.

Taking the Cutting.

Pepper is normally planted from cuttings taken from the growing vines. For the first two years vines need constant pruning and it is from these immature vines that cuttings are taken. Cuttings from mature vines do not grow well. A cutting should have a minimum of five and a maximum of seven nodes (the latter is preferable) and should be taken from a terminal, not a lateral, branch.

The cuttings must be prepared whilst still attached to the parent vine.

The sequence of operations is given below and should be read in conjunction with Fig. 1.

The terminal bud should be pinched out and the leaves and side branches on nodes 3 to 7 on main stem A removed carefully by hand.

Seven to ten days later a new terminal bud will have started to grow and wounds caused by the removal of leaves and side branches will have commenced to heal. At this stage the stem should be cut cleanly below the 7th node, as shown in Fig. 1. The aerial roots arising from each node cling tenaciously to the stakes and the severed stem should be prised from the post carefully with the blunt edge of the pruning knife.

The stem is now a suitable cutting which may be used as planting material.

The terminal buds, leaves and side branches on nodes 3 to 7 on stems B and C (Fig. II) should be removed when they have grown to a height of 2 to 3 ft. from ground level. After seven to ten days these stems may be pruned and used as 6-node cuttings.

Planting the Cutting.

Cuttings are normally planted direct into the field, but a well-shaded nursery may be used. It is preferable that they be planted on small mounds as shown in Figs. I and II. If it is necessary to transport cuttings over long distances, they should be transported in boxes containing fertile, light, loamy soil of porous texture. Care must be taken to ensure that the roots are disturbed as little as possible when transplanting into the field.

Cuttings should be planted near the surface, to the east of the stake and with three or four nodes below ground level. The soil should be pressed firmly around the roots.

Watering of the cuttings is seldom necessary but it is preferable to plant them during the wetter periods of the year.

Immediately after planting, the cuttings should be kept under heavy but well-ventilated shade. Fern fronds (preferably *Gleichenia linearis*), stuck into the ground facing inwards in a close circle around the cutting, provide a satisfactory form of shade. Care should be taken to see that the fronds do not fall on the cutting. The shade is not removed until the cuttings are well established.

Fig. III is of a 7-node cutting planted in the correct manner. The leaves and side branches at the three nodes above the ground are not removed but should be trained up the stake until they form the three main stems, as at A, B and C in Figs. I and II.

Support Posts.

After the cuttings have been in the ground for four to five months, the temporary bamboo stakes should be replaced by hardwood supports, preferably of *belian* timber (*Eusideroxylon zwageri*), 10 to 14 ft. in height and sunk 2 ft. into the ground. It is important that good quality timber is used, for the vine may require supporting for 15 years or longer. Care should be taken to ensure that the cuttings are not damaged when the supports are being erected.

Experiments have commenced on a Sarawak agricultural station to see whether the vines can be trained to climb up a 5 ft. vertical support and then along an 8 ft. horizontal beam attached to the upright support. This is an attempt to reduce harvesting costs, for much time is lost and labour required in climbing ladders to harvest the berries when the vine has reached the top of a 15 ft. vertical support.

Experiments in Sarawak have shown that when living tree supports such as "kapok" (*Ceiba pentandra*) or *Gliricidia maculata* are used, the yield of pepper is much reduced. One reason for this may be that the tree roots compete with the pepper for available supplies of plant nutrients in the soil, but more important, probably, is that under the high rainfall and comparatively low sunshine conditions of Sarawak, vegetative growth rather than flowering is encouraged under shade.

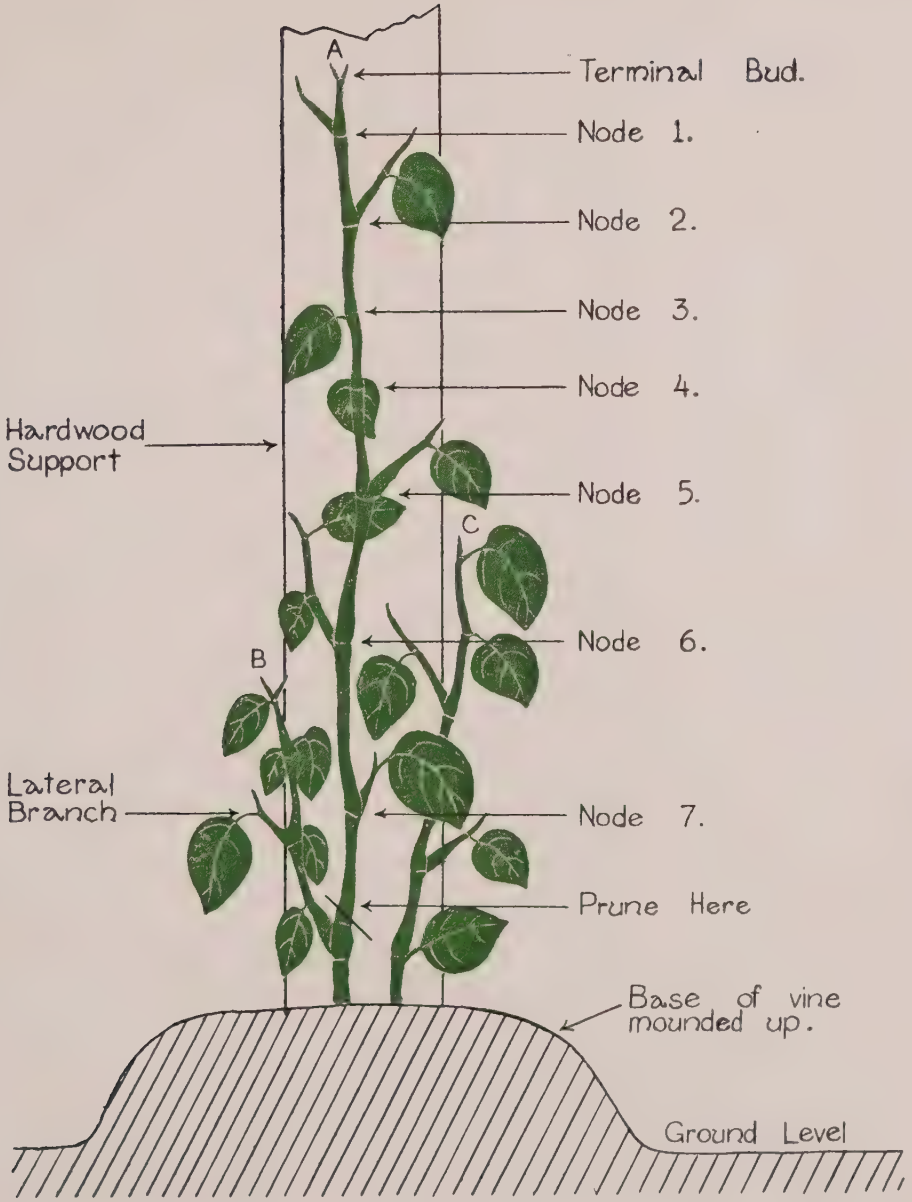
Aerial roots arise from each node and in order to induce them to cling to the hardwood supports it is necessary to tie the vines to the supports at frequent intervals as they grow up the posts. As each internode on the three main stems develops it should be tied to the post with strips of fibre. Lateral branches should not be tied as this will discourage the bushy side growth which is required.

Cultivation.

Pruning.

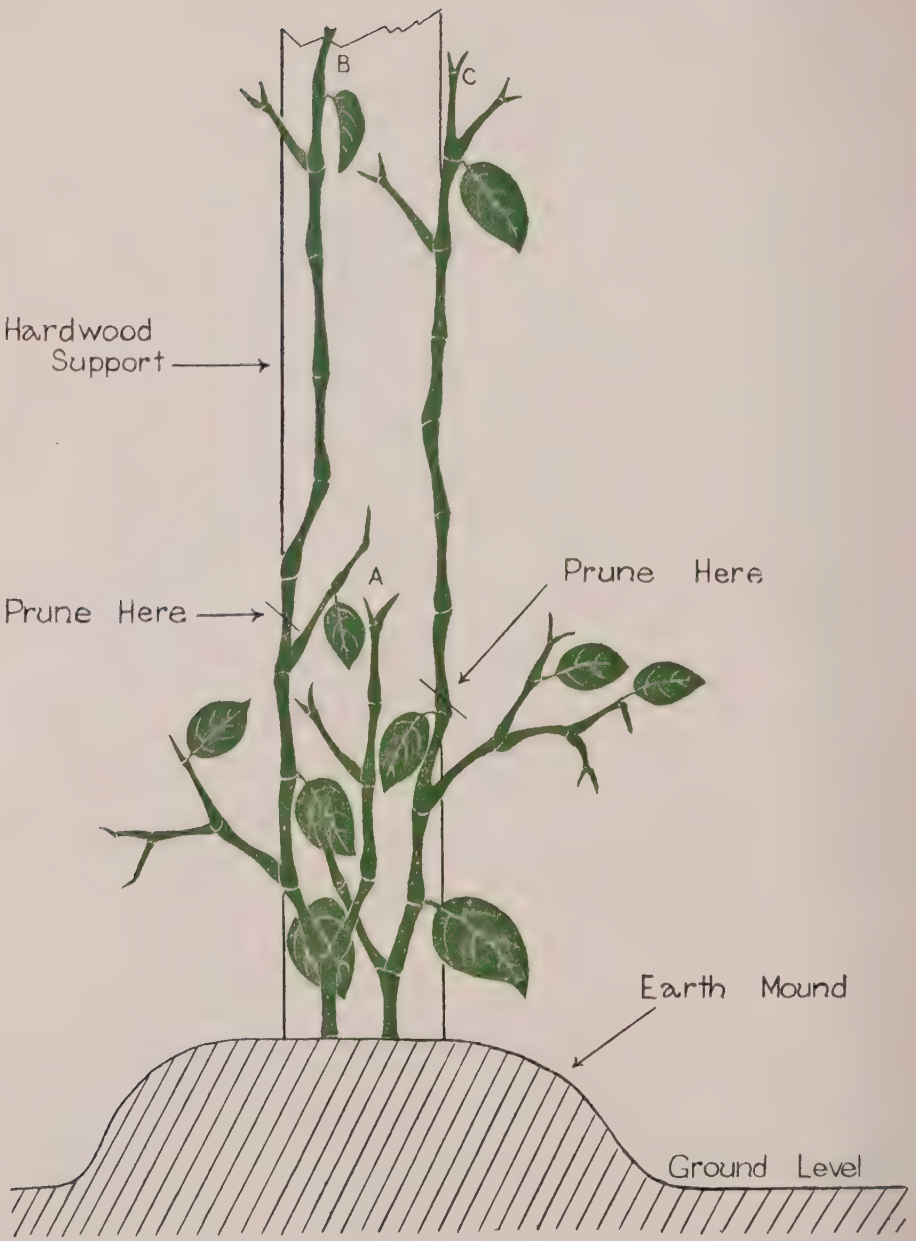
When the terminal stem has grown and there are eight or nine nodes above ground level, it should be pruned to within 6 ins. of the ground. Similarly, when the two lateral stems, derived from the second and third nodes, have grown up they too should be cut back, and can be used as planting material.

FIG. I



The diagram above shows a pepper-vine about 6 months after planting. A, B and C are the three main stems which must be pruned back periodically to encourage side branching. The terminal bud should be pinched out and the leaves or side branches on nodes 3 to 7 on main stem A should be removed, and 7 to 10 days later the the stem pruned at the point indicated. This cutting can then be used as additional planting material.

FIG. II



Main stems B and C should now be pruned off from the places indicated; as the side branches and leaves have already been removed preparatory to pruning. They will now make six-node cuttings suitable for planting out.

The three main stems, i.e. the terminal shoot and two top, lateral branches, should be trained up the support and tied to it at frequent intervals. When these stems have developed ten more nodes they should again be cut to within three or four nodes of the place where they were pruned previously. Pruning in this manner is continued until the vine reaches the top of the support, i.e. the stems are pruned seven or eight times. Previous pruning places can be easily recognised by swellings in the plant tissues and by old, woody growth behind the cut. When the vine reaches the top of the post it should be pinched out periodically to prevent it growing higher.

The object of pruning is to encourage the growth of thick, bushy side branches. One lateral side branch should develop from each node, and this can only be achieved if the vine is pruned correctly. The vine should be as wide as possible and the outside canopy should have a thick mass of leaves and branches bearing fruit spikes. Sometimes there is a gap in the outer canopy and a lateral branch should be trained to fill it. This can be done by wedging a small stone or piece of wood in the join between the branch and main stem, so forcing the branch into the gap.

Side branches which lie close to the ground and which might impede the free circulation of air should be removed. An indication that this circulation is being impeded is sometimes given by the earth beneath the vine becoming green with mould. Fruit spikes which touch the ground are inclined to develop *Cyphella* fungus disease.

Leaves growing from any of the nodes on the three main stems should be removed to allow sufficient movement of air around the centre of the vine.

Flower spikes produced within 18 months of planting should be removed to induce strong, vigorous growth. During the next six months, i.e. until the plant is two years old, only a few flower spikes should be allowed to develop into berries. When the vine is more than two years old it should be allowed to flower and fruit freely.

Most of the leaves on the vine should be removed to encourage the growth of side shoots and, later, to encourage flowering, but the following are exceptions:—

1. Any leaves growing on the three main stems within 2 ft. of the tips, for, until the main stems reach the top of the hardwood support, the upward growth of these stems must not be interfered with. These leaves may be plucked after the stems have reached the top of the support.
2. Any leaf forming part of an axil from which a branch is beginning to form. Such leaves may be recognised by their thicker and longer stalks.
3. The two leaves on the extreme end of each main branch, or the leaf on the end of each subsidiary branch.

The vines should be manured liberally when pruning has been carried out.

Harvesting.

Harvesting generally takes place from May to July but in some areas may continue into November.

As mentioned earlier, the vine should not be allowed to flower freely until it is two years old, which means that the first harvest will not be taken until the plant has been growing for about 28 months. When it is three years old, the plant will have reached the top of the support, and from then on yields will increase until they reach their maximum at five to seven years of age. Yields then begin to gradually decrease, but if the vine is properly maintained it is possible for it to bear fruit for 15 years or more.

When the berries first form on the fruit spike they are green in colour, turning yellow as harvest time approaches and red when ripe. The fruit spike should be picked as soon as one of the berries on it commences to turn red. If the picking is done at this stage the berries will be of fair size but not ripe enough to be eaten by birds or to drop off the vine.

Three-legged ladders are used for harvesting berries that cannot be reached from the ground. Pickers mount the ladders with baskets tied to their waists and pluck the berries with both hands so that the small, tender side branches are not damaged. It is necessary to pick over each vine about once a week during the harvest period.

Fruit spikes which have been damaged by insects, disease or other causes normally fall to the ground and, if left for a day or so, turn black. These berries are harvested separately and marketed as black pepper.

When harvesting is almost at an end, all fruit spikes, whether they possess unripe berries or not, should be picked from the vines to ensure that the vines fruit evenly and come into bearing at the same time during the next harvest season. The unripe berries may be dried in the sun and sold as black pepper.

When the final harvest operation has been completed, the leaves should be plucked and the vine heavily manured.

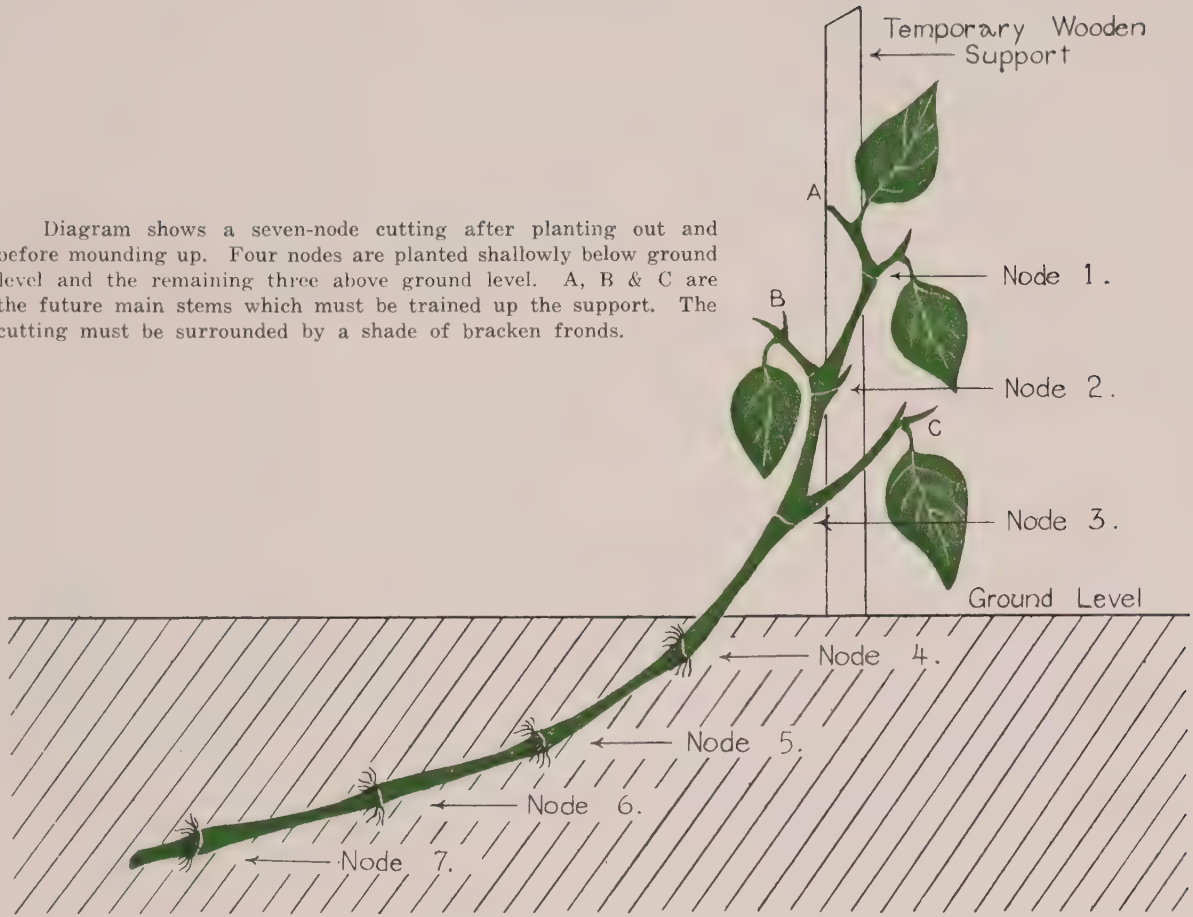
Manuring.

Pepper is an "exhausting" crop in the sense that a fairly high level of nitrogenous manuring is necessary if reasonable yields are to be obtained. Experiments are now in progress to ascertain which manure gives the best results and the best method of applying it. There is some evidence that manures, particularly artificial manures, give better results when applied a little at a time and often rather than in large quantities once or twice a year.

Bat guano from the Niah caves at Miri has, in the last few years, become an extremely popular organic manure with pepper cultivators. It is usually applied by the placement method, a small handful (about 3 ozs.) being placed in a hole not less than 8 ins. from the main stem of the vine. Applications are made every two months.

FIG. III

Diagram shows a seven-node cutting after planting out and before mounding up. Four nodes are planted shallowly below ground level and the remaining three above ground level. A, B & C are the future main stems which must be trained up the support. The cutting must be surrounded by a shade of bracken fronds.



Prawn refuse and fish meal are applied in considerable quantities by Chinese gardeners. Up to 4 lbs. of prawn refuse or fish meal may be put in a shallow trench encircling the vine every two to three months.

Soyabean cake is also used as a manure by the Chinese.

Trials with artificial fertilisers are being carried out but it is, as yet, too early to make recommendations.

Until recently, the Chinese gardener always gave each vine a liberal supply of burnt earth. The burnt earth was obtained by systematically stripping the topsoil off nearby areas, and so rendering those areas useless for cultivation. Up to five acres of land was required to supply burnt earth for one acre of pepper garden. The practice is strongly discouraged and is, fortunately, dying out.

Mulching.

A common feature in pepper gardens is the bare earth between the rows of vines, which, especially on hilly land, results in serious soil erosion. In order to prevent this, it is recommended that the ground between the rows be mulched with *lalang* slashings. This is undoubtedly effective but the mulch tends to harbour snails and there is a definite fire risk.

Pests and Diseases.

The following insect pests have been found damaging pepper vines in Sarawak:—

Mealy bug (*Ferrisia virgata* (Ckll.))
Green bug (*Dasynus piperis* China.)
Pepper weevil (*Lophobaris serratipes* Mshll.)
The sucking bug *Elasmognathus hewitti* Dist.
White ants.
Stem-boring caterpillars.

Snails sometimes attack and kill newly planted vines.

An unidentified fungus, probably *Fomes lignosus*, sometimes attacks the stems but not the roots of the vines. It appears that infection comes from old pepper supports which have been left in long-abandoned pepper gardens.

Other diseases encountered are:—

White thread disease (*Thelephoraccae cyphella*)
Black berry disease caused by an alga *Cephaleuros mycoidea*
A yellow rust, not yet identified.

There are a number of other diseases of lesser importance which have not been identified yet.

Healthy, vigorously growing vines seem less prone to attack by disease, and it is important therefore that plenty of attention is given to improving the health and vigour of vines by means of better methods of cultivation and by adequate manuring.

Preparation of the Berries for Market.

There are three stages in the preparation of the harvested berries as white pepper for market; these are soaking, washing and drying, and are described below.

Soaking.

The harvested berries are put into sacks and soaked in a pool or stream for seven or eight days to rot the outer skin or pericarp of the berries. The finished product should be white in colour, and this can only be attained if the sacks of berries are soaked in running water. Stagnant water gives a brownish colour to the berries.

In Sarawak, where streams and rivers are liable to rise several feet within a short time after rain, the soaking sacks of berries are surrounded by a strong fence to prevent them being washed down-stream.

Washing.

After soaking for about a week, the berries are removed from the sack and put into a hardwood tub where they are trampled on by foot. Washing is necessary in order to remove the stalks and decayed pericarp from the pepper corns. For the process of washing, the corns are placed in oblong, rotan baskets which are made so that the water and decayed pericarps can filter through. The corns are alternately washed and rubbed by hand for about five minutes until they are clean. Difficulty in removing the pericarp means that the berries were not soaked long enough.

Drying.

After washing, the corns are spread out on rotan mats or on a concrete floor to dry in the sun. If the corns are not dried directly after washing they will turn black. Drying is a very important stage in the preparation of pepper and, in average weather, should be continued for not less than three days. A certain amount of experience is required to tell when the corns are dry enough for bagging; this is usually ascertained by letting the corns run through the fingers to see whether they run through freely or stick together due to dampness. Alternatively, if the corns are difficult to crack with the teeth they are probably dry enough. Under-drying causes loss of the desirable white colour and a diminishing of the tart, spicy flavour.

Loss in weight when the corns are dried correctly is in the region of 30 per cent. The finished product should not have a moisture content greater than 10 per cent.

Black pepper which, as mentioned previously, is usually prepared from unripe, injured or dropped berries, is prepared by drying the berries for two or three days in the sun. The berries must not be soaked in water.

Yields.

When the vines are first allowed to come into bearing, 28 months after planting, they yield 2 to 3 *katis** of dry pepper each. The second and third harvests average at least 6 *katis* per vine, but after this the yields are expected to decline under the present system of cultivation in Sarawak, although evidence now available suggests that provided proper soil conservation methods are adopted and manuring is adequate then good yields can be maintained for far longer periods than at present.

* 1 kati = 1⅓ lbs.

NEW OR RECENTLY INTRODUCED INSECT PESTS IN SINGAPORE, ABSENT FROM THE FEDERATION OF MALAYA

BY

R. J. A. W. LEVER,

Entomologist.

By reason of the huge *entrepot* trade of Singapore the entry into it of unwanted insects is not unexpected, yet the arrival there within the last few years of some potentially serious pests is a matter of concern for everyone in both the Colony and the Federation of Malaya.

Six insects and one mite which have been recorded in Singapore since 1949 are dealt with in the order in which they were reported and notes on their known distribution elsewhere are supplied.

1. *Coptotermes parvulus* Holmgr. Termitidae, (white ant). This termite was taken by the writer from a beached ship at Singapore Naval Base in July, 1949. Originally described from Bombay in 1913; taken in Java in 1934. It is closely related to *C. curvignathus* Holmgr., a common pest of rubber trees in Malaya and Indonesia.

2. *Promecotheca cumingi* Baly. Hispidae, (Philippine coconut leaf-mining beetle). Found by the writer on coconut leaves in the grounds of an hotel in April, 1951, and later taken on betel nut, oil palm and royal palm but the attacks here were minor. This is a serious pest in the Philippines and was very fortunately quickly brought under control in Singapore by attacks of local parasites (two egg and two larval) of which *Pleurotropis parvulus* Ferr. was the most efficient. Although it was recorded in 1917 in Malacca it failed to become established and had not been taken in Malaya since 1918. (See *Malayan Agricultural Journal* for April, 1951).

3. *Dolichotetranychus floridanus* (Banks). Acarina, (red spider or mite). Forwarded in July, 1951, by a private orchid grower who found it in the sheath and leaf-axils of an Australian *Dendrobium*. It proved very resistant to spraying with nicotine and mercuric chloride. The type locality of this mite is Florida where it occurs on pineapples, but the Commonwealth Institute of Entomology state that it is increasing in economic importance on grasses in North, Central and South Africa and it also occurs in Celebes. Clearly this is a most unwelcome introduction in view of its habits in countries into which it has been introduced and its resistance to control by insecticides.

4. *Caryobruchus gleditsiae* L. Bruchidae, (seed weevil). Intercepted by the Agricultural Officer, Singapore, in October, 1951, in a consignment of seeds of palms (*Coccothrinax* spp.) from Florida, U.S.A. These beetles are confined to southern U.S.A., Central and South America.

This was apparently a case of a completely successful interception as the beetle did not, as in the other cases, get beyond quarantine inspection on its arrival and so become established. The seeds were inside a plastic container packed in sawdust in a carton and no insects escaped.

5. *Dizygomyza cepae* Hering. Agromyzidae. A small fly whose maggot bores in the leaf-sheaths of onions and shallots. Forwarded by the Agricultural Officer, Singapore, in November, 1951, from the Naval Base. When identified, through the Director of the Commonwealth Institute of Entomology, it was stated ".....this is presumably the first extra-European record of this insect, which was first discovered in 1926 in Central Germany where its larvae occurred in millions in onion fields giving them a greyish hue." This is a most unexpected record especially as the concealed habits of the fly make it difficult to control inside the plants.

6. *Plodia interpunctella* Hbn. Pyralidae, subfamily Phycitinae, the Indian meal moth. Imported in currents from Australia and forwarded by the Royal Army Service Corps, Singapore, in December, 1951. Found throughout the world but until this time it had not come into Malaya as far as existing records show. The currants, condemned for use by the Army authorities, were sold to local distributors so its local spread is possible by ordinary trade channels. In Europe and the U.S.A. the Indian meal moth is a troublesome pest of such stored products as grains, prepared cereal foods, dried fruits, seeds, roots and powdered milk. This wide range of foods on which the caterpillars feed shows how very easily it could be distributed.

7. *Gnorimoschema operculella* (Zell.), Gelechiidae, the potato tuber-worm. Imported in stored potatoes from South Africa, specimens forwarded by the South African Trade Commissioner via Director, Raffles Museum, March, 1951. It occurs on tobacco in India, Burma, Celebes and Java and so is established in a not distant part of South East Asia. Found also in the southern United States where it is a serious pest of potatoes and growing tobacco. Here again, distribution in infected material would be very easy were the moth to gain an initial foothold.

Risk of Importation of Pests.

It will be apparent from the above that the risks of injurious insects gaining entry into the Federation, either indirectly via aircraft and ships arriving in Singapore, or directly at Penang and at Port Swettenham, are very real. The number of serious pests which have gained entry at ports in other countries in recent years is considerable; to cite only one instance there is the establishment in Hawaii of the Oriental fruit fly, *Dacus dorsalis* (Hendel). This insect appears to have gained entry at Honolulu in 1945, probably from Saipan. It necessitated an almost world-wide search for parasites in which, as it happens, Malaya contributed three species of *Opius*. While this particular example of biological control seems likely to be successful, it would clearly not have been necessary had the pest not been carried past the quarantine barriers and thus become established.

The danger from the illegal importation of plant material is that although this material may seem to be free from pests, yet scale insects and mealy-bugs may often be hidden in the axils and sepals while seed-borers, stem-borers and leaf-miners can be concealed within the plant. Plant diseases can, of course, arrive in the same way through undeclared material which is infected with fungi or bacteria.

Application for a permit by residents before importing any plant material ensures optimum measures being carried out so that the chance of unwanted pests and diseases arriving is kept down to the minimum. This is the only available method to check the arrival of dangerous insects from overseas which when established may prove very difficult and costly to eradicate.

It is hoped that the above examples of pests which have actually gained or were intercepted in the act of gaining a foothold in Singapore will serve to show the real necessity for a vigilant quarantine and the need for everyone to co-operate with the authorities.

NOTES ON CURRENT INVESTIGATIONS, JULY TO SEPTEMBER, 1952.

Compiled by the Acting Chief Research Officer and the Senior Agronomist.

Padi.

1. Research.

Variety Trials.

All results received of variety trials carried out in the 1951-52 season have been analysed. New trials commencing this season are concerned mainly with testing new selections in various localities. New trials of unselected varieties are now only being laid down in areas where such trials have not been carried out previously, e.g. Kuala Selangor.

Variety Selection.

The new selection programme summarised in the last quarterly report is now well under way without serious mishaps. Planting was delayed at some stations owing to water shortage.

Results from the selection lines of Acheh Puteh at the two Kuala Selangor stations have been received and analysed. Progress has not been satisfactory owing to rat damage and poor water control. The 222 lines at Panchang Bedena have been reduced to 92 for the coming season but at Sungei Burong, of the 313 lines grown last season 264 will have to be carried forward.

Primary multiplication plots of the better selections of Serendah Kuning and Nachin have been laid down in Negri Sembilan and Malacca respectively to provide seed for extension trials and general distribution.

Ear row plots of mass selected material of Seraup (Titi Serong, Perak), Serendah Kuning (Negri Sembilan) and Nachin (Malacca) have been laid down to compare the efficiency of mass selection with that of ear row selection. A similar project commenced on Radin Ebos at Telok Chengai, Kedah, last season is being continued. The 200 lines then selected have been reduced to 24, which have been planted in comparison with the better lines from the main ear row selection programme and with the variety M.E.80 as a control.

Extension Trials.

Arrangements have been made for an extension trial to be carried out at some 60 sites in South Krian, Perak, with the variety Seri Raja which has proved high yielding at padi stations in this area. A similar trial on a more limited scale is being conducted in the Raub/Lipis area of Pahang with the variety Radin China 17. A dummy extension trial is to be run in the inland padi areas of North Kedah to discover technical and administrative difficulties, and will be followed by a 'live' trial with S.S.D. 25 in 1953-54.

Hybridisation.

Seed of four *indica* x *japonica* crosses received from Cuttack, India, gave excellent germination and was transplanted at Pulau Gadong, Malacca, on the 10th October. Six plants of each cross sown in the cage at Kuala Lumpur on the 26th July have grown well; they promise to be very short term varieties of 90 to 120 days maturation period. One plant flowered in 51 days and about half had flowered by the end of September (66 days). All four progenies are segregating actively and should provide ample scope for selection.

Of a number of introduced varieties from Borneo, Hong Kong and Hungary under observation at Kuala Lumpur, the Hungarian variety flowered in 46 days and is averaging over 19 ears per plant and, though the ears are small, it should prove a useful parent.

Forty-four F_2 families of 14 crosses made in 1951, and 1,250 F_1 plants from 61 crosses made in the past season have been planted out at Pulau Gadong.

Efforts to devise a satisfactory emasculation and pollination technique are being pursued at Kuala Lumpur with some success.

Time of Sowing Experiment.

Only two experiments are being continued, those in cages at Kota Bharu, Kelantan, and at Temerloh, Pahang, the former to determine the effect of time of sowing and maturation period on yield and the latter to select a short term variety suitable for flood damage avoidance in Pahang.

Survey of Plant Nutrient Contents of Padi Crops.

A total of 300 samples of padi straw and ears from the "Mixed Major Nutrients Experiments" has been received for chemical analyses from Test Stations in Kelantan, Perak, Province Wellesley and Malacca.

Biological Control of Stem-borers.

A total of 6,197 *Paratheresia* had been released in a small area in Province Wellesley up to the 16th September, 1952, but so far there have been no recoveries in the field. Failure to recover this parasite in the field does not, however, indicate complete failure, and it is possible that recoveries may be made later.

2. Agronomic Investigations.

Wet Padi.

Practically all experimental results from the 1951-52 season have now been received and statistical analysis of 52 per cent. has been completed.

In the current season, manurial investigations have been intensified on the north-west coast and many experiments have already been laid down. Satisfactory early growth with visible response to different fertiliser dressings has been reported from the early planted stations of Ulu

Klawang and Kendong, Negri Sembilan. In parts of north Kedah there has been a shortage of irrigation water and transplanting has been delayed in consequence.

Dry Padi.

In Kelantan heavy rain delayed sowing at Kampong Pusu but cultivation at Melor was largely completed under good conditions. Most experiments were sown by the end of August.

Cacao.

1. RESEARCH.

State and Settlement Amelonado Seed Gardens.

A total of 650 seedlings and 350 cuttings has been sent to Kedah; of these 150 were single leaf cuttings. A further 390 seedlings and 1,540 cuttings should be ready for planting before the end of the year and will be sent to Johore, Kelantan and Negri Sembilan.

With the usual dry weather and seasonal regression of fruiting, output of Amelonado seed has fallen off.

Vegetative Propagation.

The new hardening bins with "Perspex" lids have been completed and brought into use using the New Guinea method. The first batch of plants has just been removed with no losses among the Amelonado plants and 10 per cent. deaths in the Trinitario, a marked improvement over results from the old bins.

Pest Control.

In addition to *Apogonia cribricollis* Burm. and *A. expeditionis* Rits., already reported, it has since been found that some damage to the leaves is also caused by *A. laevicollis* Lansbr. and *A. aeneocuprea* Msr. but both are less numerous.

Disease Control.

A stem canker of a type not previously observed was recorded from an estate in Trengganu. A species of the fungus *Gloeosporium* was isolated. It appears probable that the disease is initiated by insects which damage the young stems, the fungus gaining entry through the wounds and subsequently causing canker.

A stem disease in which the bark became dark purple in colour and a firm brown rot spread upwards through the wood was associated with a species of *Nectria*. A species of *Nectria* has also been found causing a rot of young pods. As in the case of the species on the stem, a *Fusarium* stage is commonly present and appears in profusion before the *Nectria* frutifications are produced.

Red root disease (*Ganoderma pseudoferreum*) continues to cause trouble and has occurred recently on a young planting in Selangor.

2. Agronomic Investigations.

At Kuala Lipis Agricultural Station, Pahang, some very healthy Trinitario cacao has been raised by methods approximating to those adopted by Malay smallholders when establishing kampong fruit trees. Cacao has been planted 6 x 6 ft. and many other miscellaneous fruit tree seedlings have been allowed to grow in the area, together with some rubber seedlings and plants of Manila hemp and Gliricidia. The ground surface is bare of weeds because of heavy shade and there is a marked absence of insect damage. It is probable that such an establishment method would only be applicable to the richer soils and more gentle slopes, and it would certainly be difficult to fit into estate practice. Nevertheless, the demonstration indicates that cacao establishment by smallholders is likely to be comparatively successful on virgin soil, as the crop's requirements in the early stages are similar to those of such fruit trees as durian, langsat and mangosteen.

From Ayer Itam Agricultural Station in Penang, where an establishment cacao trial of Trinitario cacao was abandoned and budded in February, 1952, with West African Amelonado, it is reported that this budding was 95 per cent. successful and that the more forward trees are now 7½ to 9½ ft. tall.

A clonal trial has been planted at Gajah Mati Agricultural Station in Kedah using shade of secondary jungle.

Failure of cacao nurseries on a north Selangor coconut estate has been attributed to watering the seedlings with slightly saline water.

Progress of cacao experiments on granite soil in Trengganu has been generally satisfactory and Amelonado seed gardens in this area have shown very promising growth under jungle shade. A branch-canker which caused some alarm has been found to be due to secondary infection following damage by *Helopeltis* bug.

Some quite severe leaf-scorch noted at the Federal Experiment Station, Serdang, was found to be caused by the use of a white-oil emulsion for controlling mealy-bugs. Care must be taken not to use such sprays too strong or in full sunlight.

Oil Palm.

1. Research.

Dumpy Palm.

Dumpy palms have recommenced producing female inflorescences and the pollination rate has improved.

Harvested dumpy palms have yielded 6,808 seeds. Seed of three progenies (1,450 seeds) has been sent to the West African Institute for Oil Palm Research, Nigeria; 4,093 seeds of nine progenies have been sent to estates and the remaining seed has been sown at Serdang.

Oil Palm at Various pH Levels.

Leaf samples have been taken for chemical analyses from the palms of these experiments.

Although the calcium content of the leaf from the lime-treated palms was approximately three times as much as the sample from the palms of the unlimed pots, and magnesium twice as much, the potash in all these samples was practically of the same order. In this case, there would seem to be no "antagonism" between potash and calcium.

2. Agronomic Investigations.

At the new Federal Experiment Station, Jerangau, in Trengganu, burning in a 17 acres clearing was delayed by wet weather in June and July but subsequent progress has been satisfactory and a leguminous cover crop has now been sown. A large progeny trial is due to be planted shortly and lining and holing is in progress. Nursery seedlings of these valuable progenies are all in excellent condition.

Coconut.

1. Research.

Pest Control.

Artona catoxantha Hamps. An estate in Province Wellesley, where an outbreak was reported on the 18th June, was visited by the Senior Entomologist on the 4th August. This visit coincided with the emergence of moths, and freshly deposited eggs were found.

An initial field count gave an overall parasitism by *Ptychomyia* of approximately 30 per cent., subsequently corrected after examination of material in the office, to 19.3 per cent. for cocoons and 24 per cent. for larvae. The overall figure for June was about 13 per cent.

Fibres.

1. Research.

Disease Control.

Manila hemp. A stem of Manila hemp infected by stem rot caused by *Marasmius stenophyllus* has been under observation in the laboratory for five months. During the whole of this period numerous fructifications of the fungus have been produced periodically. This indicates that an important part of the control measures taken against the disease is the destruction of affected stems which might otherwise provide an important source of infective material.

Another stem disease, hitherto unrecorded in Malaya, was seen at the Federal Experiment Station, Kuala Lumpur. The cause of the disease was the fungus *Helminthosporium torulosum;* the symptoms were a dark brown rot of the outermost leaf sheath, gradually spreading inwards and causing premature withering of the outer leaves. Attack has so far been slight.

Bacterial wilt, suspected of being caused by *Xanthomonas solanacearum,* has not reappeared during the recent dry weather,

2. Agronomic Investigations.

Yields of Manila hemp in a variety trial at Serdang are showing some improvement as a result of a manurial programme which commenced in July, 1951.

Another variety trial in which four Temerloh selections are to be tested against Bangulanon and Tangongan has been planted at Sg. Ruan Agricultural Station adjoining a new village in Pahang. Early growth has been satisfactory. The soil is of granite origin and the site undulating.

Growth of Temerloh selections at Raub Agricultural Station, Pahang, has proved to be very susceptible to impeded drainage.

Ramie variety trials are in progress at Temerloh and Kuala Lumpur. Early yields have been relatively poorer at the former locality and the varietal order of yield differs.

A ramie factorial manurial experiment on peat at the Federal Experiment Station, Jalan Kebun, Selangor, has been concluded because of poor yield responses. Further investigations are planned.

A jute factorial manurial experiment has been re-sown on muck soil at Sg. Burong Agricultural Station, Selangor, and both germination and early growth have been satisfactory. A variety trial which was recently harvested at the same locality has shown *C. capsularis* var. *Segama* to be outstanding and all available seed has now been sown in multiplication plots in Kuala Lumpur. This variety, alone of those tested, possesses the all-important character of delayed flowering which is associated with very tall growth.

Tea.

1. Research.

Selection.

A further batch of 19,000 cuttings from selected bushes at Cameron Highlands were planted at the end of the quarter and checking shooting of previous batches was in progress. Cuttings taken in February last have grown better than those taken in November, 1951.

Disease Control.

Blister blight (*Exobasidium vexans*) has been at a very low level at Cameron Highlands during the past few months of dry weather. Yields from the monthly pruning experiments at the Agricultural Station, Tanah Rata, continue to be recorded and are beginning to give interesting results. They indicate that under the climatic conditions at the Station, spraying of tea during plucking gives no increase in yield.

2. Agronomic Investigations.

Rooting trials of clones are in progress at Serdang and at Cameron Highlands. These trials involve a great deal of work, but they are proceeding according to plan.

Pineapple.

1. Research.

Selection.

The survey of variation in fruit characters at canneries and plantations in Johore and Selangor has been completed for the 1952 main (April to August) season.

Initial selection in the field of a foundation stock of Singapore Spanish pines has been completed; 1,100 clones and a mass selection plot of 1,750 plants have been planted at the Federal Experiment Station, Jalan Kebun, Selangor. Six hundred suckers of the Sarawak variety have also been planted at the same station for study and selection.

2. Agronomic Investigations.

A 2^6 factorial manurial, cultural and variety experiment has been designed and planting is now in progress on peat soil at the new Federal Experiment Station, Alor Bukit, in Johore.

In the first ratoon crop of a manurial experiment on a Selangor estate there were good responses in yield to inorganic N.P.K. and residual responses to organic fertiliser. There was no response to an application of 5 cwts. per year of magnesium limestone. The mean yield of fruit from this crop was only 10,835 lbs. per acre. The second ratoon crop averaged 25,522 lbs. per acre of fruit but differences between treatment yields were non-significant.

Pasture and Fodders.

Pasture Grass Experiment.

The analytical work in connection with several green fodder and pasture grass experiments of the Agronomy Branch was continued. A total of 200 samples was analysed during the quarter.

Axonopus compressus *and* Axonopus affinis—*Shade vs. No Shade Experiment.*

Monthly samples have been taken for analysis. The samples of both species of grasses from the shaded plots have recently had higher protein contents.

Vegetables and Foodcrops.

1. Research.

Sweet Potato.

Yields of tops of varieties in the collection at the Federal Experiment Station, Serdang, are being estimated by successive cuts. One cut has been made and another will be taken shortly.

Tomato.

A series of experiments has been started at the Federal Experiment Station, Kuala Lumpur, to investigate the possibility of controlling

bacterial wilt (*Xanthomonas solanacearum*) using tomato (the most susceptible host) as the test crop.

Maize.

Two field trials were laid down to test the effect of spraying maize with Peronox for control of diseases. Leaf scorching was reduced by spraying early in the morning.

Long Bean.

A field trial to test the effectiveness of two soil treatments in controlling *Fusarium* wilt of long bean has been completed. The soil fumigant chloro-bromo-propene applied at a rate of 4 ml. per sq. ft. of soil reduced the incidence of the disease although control was by no means complete.

French Bean.

French bean was attacked by bacterial wilt (*Xanthomonas solanacearum*) in Kuala Lumpur. This is the twenty-third susceptible species to be recorded in Malaya.

Corticium solani, the perfect stage of the common *Rhizoctonia solani*, was found for the first time locally. First seen on soya bean, it has also been observed since on French bean and *Centrosema plumierii*.

2. Agronomic Investigations.

Investigations are in progress at the Federal Experiment Stations, Kuala Lumpur and Cameron Highlands, and at Sg. Buloh Agricultural Station, on Chinese vegetables. The Japanese variety of Pak Choy known as Kyoto No. 3 has been shown to give satisfactory yields of good quality produce as compared with two common varieties of Chinese origin.

In Choy Sam trials at Kuala Lumpur and Sg. Buloh the Japanese "Karshima" variety proved to be very inferior both in quality and yield to the common Chinese flowering Choy Sam. The crop from locally raised seed was of good quality at both localities but gave an inferior yield at Sg. Buloh to that raised from freshly imported Chinese seed. It has been established, however, that satisfactory seed can be raised locally, and no doubt further selection work would improve yields.

Sutton's Chinese White Lobak of Indian origin has given excellent yields in Kuala Lumpur and was significantly superior to the other five varieties tested.

Local cucumber has outyielded all other varieties tested in two trials.

Fruits.

The Mexican variety of Hawaiian papaya has yielded fruit of excellent quality at Cheras Agricultural Station in Selangor. The fruits are very large and have been shown to can well.

A rambutan and durian manurial trial at Rembau Agricultural Station, Negri Sembilan, has been abandoned because the land is required by the local administration for building sites.

In a strawberry mulch and variety trial at Cameron Highlands, Cambridge 448 has shown the best growth to date.

A large fertiliser factorial trial has been superimposed on a 1947 planting of King oranges at Degong Agricultural Station in Perak with a view to determining the effect of different fertilisers on yield and fruit quality.

Livestock.

1. Research.

Animal Feeding.

Renewed interest has been taken on problems connected with animal feeding, especially with poultry mashes and rations for pigs and goats.

At the request of the Controller of Supplies, Federation of Malaya, that reasonably priced but carefully balanced poultry mashes should be made available to the public, several formulae for suitable mashes for chicks, growers and laying hens have been prepared. It was also important that these mashes should include a large proportion of locally produced feeding stuffs.

2. Agronomic Investigations.

Three Bali calves have been born at Serdang and all are healthy.

Thirteen kids were born during the quarter in the Serdang goat herd but only three were pure-breds. The two best milking does averaged 7.9 and 6.8 lbs. of milk per day.

A goat feeding trial has been started at Bukit Mertajam Agricultural Station, Province Wellesley, in order to compare the growth-rates of half-breds and local castrated males. This experiment will be a cumulative one with animals added as they become available. At present eight goats are under trial.

Some interesting poultry investigations are in progress at Cheras Agricultural Station, Selangor. In one trial, growth rates and egg production of different Rhode Island Red strains are being compared. Already, marked differences between growth rates, as judged by body weight, have been detected but these differences will not necessarily be correlated with egg production.

Trials with imported ducks have been affected by low fertility of drakes. It would appear that the local drake x imported duck cross is more productive than the reciprocal.

Miscellaneous Pests.

Stored Products.

Consideration is being given to improved methods of storage, particularly for padi and rice, a subject in which this Department, and

in particular the Botanical and Entomological Divisions, has taken a very active interest for at least 20 years. Information has been gathered on the subject of mechanical driers and storage methods and expert advice has been sought from the Colonial Liaison Officer for Stored Products in the United Kingdom.

Flies.

The Senior Entomologists of the Department of Agriculture and Institute for Medical Research visited Cameron Highlands in August and made a survey of fly breeding places. Their findings have been submitted in a joint report.

Miscellaneous.

Two-year old vines of conophor nut, *Tetracarpidium conophorum*, are now bearing fruit at the Federal Experiment Station, Serdang. This crop continues to grow very strongly in Kedah but no flowering has yet been observed.

MECHANISATION

Half-yearly Progress Report, April to September, 1952.

Compiled by the Senior Agronomist and Agricultural Engineer.

Recent Importations.

The following new types of tractors, implements and machinery have been received:—

Cuthbertson Water Buffalo soft-land tractor.
Ferguson T.E.F. diesel tractor.
Howard Gem Series IV rotavator.
Howard Bantam rotavator.
Dennis motor mower.
Wilder Pitch Pole harrow.
Ferguson post hole digger with 12 in. auger.
Ferguson earth scoop.
Weeks crop sprayer for M.G.5 tractor.
Ransomes Ceres and Ayuda single-furrow mouldboard buffalo ploughs.
King Cyclonic Pneumatic grain conveyor.
Bentall Cake Crusher.
Fyna Master Hammermill with elevating fan and cyclone.
Gascoigne two-unit goat milking plant.
Wumag Fips ramie decorticator.

Tests and Modifications.

Cuthbertson Water Buffalo Soft-Land Tractor.

This is a 70 H.P. tracklaying tractor designed specifically for use on peats and other soft soils. The Albion engine and transmission are mounted in a fabricated waterproof, boat-like hull, which allows the tractor to travel through swamps and protects the engine from mud and water.

The tracks are of a new, patented design, the steel track plates being joined together with flexible rubber pads in which are embedded wire cables which impart strength to the assembly. The track is driven by the front sprocket and the weight of the tractor is carried on seven pairs of independently mounted idler wheels. The flexibility of the tractor and the mounting of the idlers allow the tracks to follow ground contours very closely so that the weight of the tractor is more evenly distributed than is the case with rigid, girder-type tracks.

The track plates fitted to the Department's tractor are 30 ins. wide and the static bearing pressure, with an all-up weight of some 15,750 lbs., is calculated to be 2.49 lbs. per sq. in. The track plates are fitted with grousers of special design.

PLATE I

CUTHBERTSON "WATER BUFFALO" SOFT-LAND TRACTOR.

Rotary cultivation tests on padi muck soils at Tanjong Karang, Selangor.

PLATE II

CUTHBERTSON "WATER BUFFALO" SOFT-LAND TRACTOR.

Inter-row cultivation tests on mature oil palms growing on peat soils.

When the Water Buffalo was received the Albion engine was fitted with a two-bladed radiator fan. It was found that the tractor overheated badly when at work and a four bladed "export" fan was fitted: this fan has cured all cooling troubles.

The Water Buffalo was received at Serdang in June, and it was decided that the tractor should be sent to the Tanjong Karang area of Selangor for the padi planting season, August to September. It was considered that ploughs would not be suitable for soils at Tanjong Karang, partly because they do not scour well and partly because it was thought that no tractor would be able to pull after-cultivation implements on the soft ploughed soil. On theoretical grounds it seemed probable that a rotary cultivator would be suitable for cultivation, since it would produce a tilth in one operation and, if the hoe were offset, the tractor would always be running on uncultivated land.

A rotary cultivator was therefore made up from two Howard Fordson Major rotavators. This new unit had a rotor with an effective width of 8 ft. and was attached to a frame at the rear of the Water Buffalo. The frame could be raised or lowered by cables attached to the tractor's hydraulic lifting system, but the depth of work was controlled by an adjustable wheel. The rotor was driven by the tractor's power-take-off and its speed was therefore dependent on travel speed.

Under test at Serdang the rotary cultivator unit proved quite satisfactory but it was obvious that the tractor's power-take-off shaft was grossly overloaded. After some experiments, the complete power-take-off unit was removed and heavier chain-drives and extra bearings fitted. With these modifications to the tractor, and a change of ratios within the rotary cultivator's own drive, the unit was quite successful on mineral soils at Serdang.

The Water Buffalo tractor, together with the rotary cultivator attachment, two large disc-harrows and a Ransomes' Polydisc, were sent to Tanjong Karang in the last week of July and tests continued intermittently for two months. Considerable delays were experienced through the difficulty of communication between Serdang and the test site, and the results of the trials were not very conclusive.

In general it was observed that the Water Buffalo was capable of operating on the muck soil and of towing a fairly heavy load without bogging, but none of the implements used was suitable for the particular conditions.

The rotary cultivator unit was tried on a number of occasions but it tended to become choked with a solid cylinder of soil and the low framework and depth control wheel threw up large waves of mud and left the surface uneven. The drive shaft of the unit finally broke and no further work was done.

Neither of the disc-harrows used—a Ransomes Baronet No. 3 and a John Deere Killefer—proved satisfactory as they became choked with soil and threw up waves of mud. The discs had to be cleared by hand

every few yards and the debris had to be scattered to avoid leaving the ground too rough.

The Ransomes Polydisc was not tested under field conditions as it proved too difficult to manoeuvre on narrow bunds and roads.

The conclusions drawn from the trials at Tanjong Karang were:

(1) The Cuthbertson Water Buffalo appears to be capable of operating on muck soils even when they are waterlogged.

(2) Further experiments on cultivating implements must be carried out before any progress can be made on the mechanisation of padi cultivation on muck soils.

This tractor was subsequently tested for interrow cultivation of old oil palms on shallow peat. Operating conditions were very rough but the work performed was generally satisfactory when a Ransomes Baronet No. 3 disc-harrow was used.

The B.M.B. President Tractor.

This is a small, four-wheeled tractor powered by a four-cylinder Morris engine with electric starting. The three-speed gear box provides a range of speed from 1.75 to 8.00 m.p.h. and the tractor is fitted with pneumatic tyres.

A hydraulic lift with three point mounting for the implements is available, but the model supplied for test was fitted with a manual lift operated through a ratchet by a handle beside the driver's seat.

The tractor as received was not in full working order and trials, although prolonged, were not so thorough as had been planned. It was found to be suitable for haulage work provided that the trailer used is not of the type which throws a proportion of the load on to the rear wheels of the tractor. If it were available at a low price, the President might be an attractive proposition on certain types of estate for haulage work.

The plough supplied with the tractor did not plough deep enough for Malayan conditions: a larger type of plough is available but it is doubtful whether the tractor would have sufficient power to pull it. It is considered that the coulter bracket was not strong enough for Malayan soil conditions.

The manual lift is interesting because of its simplicity and cheapness but is not a practical proposition in Malaya because most Asian operators cannot exert enough force.

A full report has been sent to the local agents and this stressed the importance of an efficient local advisory and servicing organisation.

Howard Gem Series IV and Bantam Rotavators.

These machines have been lent to the State Agricultural Officer, Selangor, for instruction purposes and have not yet been fully tested. However, an instruction book in romanised Malay has been prepared for the Gem Series IV rotavator.

Wilder Pitch Pole Harrow.

This implement can be mounted on the hydraulic lift of a Ferguson tractor. It has been used for harrowing pastures at the Federal Experiment Station, Serdang, and appears to perform satisfactorily. It may prove useful for harrowing out lalang roots after ploughing but no opportunity has arisen for testing this.

Ferguson Post Hole Digger.

This implement has been tested with a 12-inch auger and has been found to make suitable fence-post holes. However, its speed of operation is slower than that of some other similar machines on the market. The hole made is somewhat too small for adoption as a planting hole.

Ferguson Earth Scoop.

One of these scoops was tested recently and was found to be capable of excavating a 2 ft. deep trench 30 x 6 ft. in area in soft soil in 45 minutes. Once the driver had acquired a certain degree of skill the work proceeded smoothly. This implement could be used to dig shallow trenches for burying sewage or refuse and it might also be used for excavating fish ponds where the water-table was not too high. Preliminary cultivation of the soil by plough or rotavator would naturally increase efficiency.

This earth scoop is now being used for carting and spreading laterite on roads at the new Federal Experiment Station, Jalan Kebun.

Large Diameter Steel Wheels for Padi Tractors.

A number of trials with wheels of larger diameter than those normally fitted have been made on the padi test plot at Serdang. The wheels have been fitted to both Ferguson and Fordson tractors.

Under Serdang conditions the wheels were highly successful and sets have been despatched to Province Wellesley, Malacca, Kedah and Negri Sembilan for further tests.

Wavy-Edged Coulters for Mouldboard Ploughs.

In order to reduce the number of blockages occurring when heavy growths of weeds have to be ploughed under in wet padi soils, experiments were made with a wavy-edged coulter fitted to a Ferguson single-furrow plough. Preliminary tests at Serdang were very promising and the experimental coulter is now under test elsewhere.

Mounted Implements for the M.G.5 Tractor.

Considerable thought has been devoted to the question of tractors and implements for the new station on peat soil at Jalan Kebun. Ferguson tractors fitted with twin rear wheels or with Bombadier half-tracks appear to be quite capable of working on these soft soils but the M.G.5 tractor, fitted with hardwood swamp blocks, is outstandingly successful.

Three M.G.5 tractors are now employed on the station. The possibility of using normal Ransomes implements for these tractors was considered but was rejected because of the large headlands needed for these trailer-implements. Experiments were therefore made at Serdang with various types of direct-mounted implements.

A number of mounted ploughs were constructed using one or more B.M.B. bodies and different types of mounting frame. None was successful as they all had more effect on the course of the tractor than did the steering brakes. The project was, therefore, abandoned.

A successful direct-mounted disc-harrow was constructed from Ransomes Countess disc-harrow parts. Eight cut-away discs were mounted in subframes attached to the main framework in such a way that the angle of cut could be varied. The framework was made as light as possible and then heavily ballasted so that, should bogging down occur, the weights could be removed and the harrow carried away by two men. A second disc-harrow with a number of refinements has been made and both harrows have performed well.

A light, mounted, spring-tine cultivator has also been made and has proved particularly useful for after cultivations at Jalan Kebun.

Sprayers for Weed Control in Padi.

Several experimental spraying machines for the application of herbicides to growing padi have been designed. The first was a motorized unit on floats but it proved difficult to combine rigidity with lightness and the unit was difficult to handle on dry land.

Different types of booms mounted on pressure-retaining knapsack sprayers were then tested and two designs were selected for further trial.

Wild Gang Seeder.

This drill has been tested with a Ferguson tractor in Perak and Selangor. It would appear not to be suitable for sowing off-season maize on padi land because the seeder units so easily become choked with trash.

NOTES ON EXTENSION WORK, JULY TO SEPTEMBER, 1952.

Compiled by the Chief Field Officer.

Padi.

Seed Distribution.

During the quarter 35,717 gantangs of padi seed were distributed free or sold to growers. In Malacca, the seed farm programme has been extended and there are now 28 one-acre farms in the Settlement. Progeny plots have been laid down on Padi Experiment Stations to provide pure strain seed for future seed farms.

The first post-war step by the Field Branch to demonstrate pure strain padi was taken by laying down 90 *ketua* plots in Malacca. The varieties Nachin 11, Reyong 6 and a Serendah Kuning strain were supplied for 1/40 acre plots for comparison with cultivators' own stocks. Detailed records are being kept and these *ketua* plots and the seed farms have also been included in a competition for the best one acre plots. A total of $300 will be awarded in prizes.

Manuring.

In Kedah, a simple manurial trial containing three treatments and a control was laid down on 50 different sites on padi planters own land, distributed throughout the main padi districts.

In Kelantan and Trengganu, the field experiments concluded last season showed that an application of 200 lbs. per acre of a standard manurial mixture gave a profitable increase of 80 to 100 gantangs per acre. These results are of considerable importance and Government has decided to popularise the use of fertilisers by granting a subsidy for the first season. Arrangements have been made with Messrs. Imperial Chemical Industries (Malaya), Ltd., to sell the standard mixture at $8 per 100 lbs., half the market price. The State Agricultural Officer, Kelantan, reports that the widest possible publicity is being given to this extension programme by officers working in the field. Talks have been given in mosques and other places where the people gather. In the schools, talks are given to the children attending the higher classes, and use has been made of the Department of Information public address vans. It is conservatively estimated that not less than 10,000 people have been present at talks on the manuring of padi.

Mechanical Cultivation.

In the Tanjong Karang padi area of Selangor it is reported that although the weather was dry during the period, those *petaks* more than two chains from the main drains remained wet below the surface and ploughing for off-season crops was impossible. In all, the four Rural and Industrial Development Authority tractors worked for a total of

895 hours, and in spite of the difficult conditions the operations were financially successful; six more tractors arrived late in August, unfortunately too late for work this season.

Reports from other States and Settlements show steady progress in extending mechanisation. Following exploratory work by this Department in Negri Sembilan, R.I.D.A. has purchased three tractors, and a tractor has also been purchased for a new village in the Kuala Pilah district.

In Perak, the mechanical cultivation team working in the riverine mukims (Kanan) had surveyed approximately 3,500 acres; of this, 2,000 to 2,300 acres can be cultivated mechanically during dry weather. Following the completion of the survey work, the R.I.D.A. fleet of tractors is following up for work on a commercial hire basis.

In Kelantan, earlier experimental work has shown that substantial increases in yield on dry padi land can be obtained from deep cultivation. R.I.D.A. tractors are available for hire. Special posters are being prepared to give publicity to the benefits of deeper ploughing of dry padi lands.

In Pahang, demonstrations have been arranged in several areas and a five day course for departmental staff was held in East Pahang. Two Ferguson tractors have been working on a pilot scheme at Pulau Manis, ploughing old padi land. Since 14th July, 121 acres have been ploughed.

Rubber.

Replanting and New Planting.

The Rubber Research Institute and the Department are co-operating with District Officers in implementing an interim smallholding replanting scheme, pending the setting up of the more permanent organisation which will administer the funds obtained from the cess provided in the Rubber Industry (Replanting) Fund Ordinance, 1952. Smallholders can now apply for the replanting subsidy.

The Department and the R.R.I. continue to supply improved planting material under the C.D. & W. Scheme No. D1176. During the quarter 6,729 yards of budwood and 74,500 clonal seedling stumps were distributed.

The smallholders, for reasons that are easily understood, show a strong preference for clonal seedling stumps. They can rarely be persuaded to undertake the additional work and maintenance that is entailed in establishing budded plants if clonal seedlings are available. Supplies of clonal seeds have been inadequate to meet demand, and a special appeal was made to the estate industry for their co-operation in increasing supplies.

Some encouraging replies were received and optimistic plans were made for expanding clonal seedling gardens to an extent that would have provided about half of the estimated demand for clonal seedlings for the coming year. It is disappointing to report, however, that the additional

supplies have not been received in the quantities that were anticipated, and our programme, in consequence, has been very much reduced.

Fruit.

During the quarter, 4,831 budded fruit trees were sold from State and Settlement Agricultural Stations. The new villages have created an additional demand for fruit trees and efforts are being made to expand production.

Cacao.

Progress is being made in establishing, in each State and Settlement, seed gardens of imported strains of Amelonado cacao. These will serve as demonstrations and also as sources of seed supply.

Livestock.

Pigs.

During the quarter 89 Middle White boars and gilts were sold. There is a growing demand from the new villages for pure-bred stock, and in most States and Settlements the Department has been in a position to offer effective assistance. Stud centres have been opened in several of the larger new villages and stock is being multiplied to satisfy the growing demand. Quite recently, importations of Middle White boars and in-pig gilts were received from England.

Poultry.

654 head of poultry and 2,040 hatching eggs were sold during the quarter.

Under a scheme sponsored by R.I.D.A., the State Agricultural Officer, Selangor, has recently taken delivery of a 2,700 egg incubator and a complement of brooders for the commercial production of three month old birds.

New Villages.

State and Settlement Agricultural Officers continue to take an active part in organising agricultural services for the new villages.

Stud centres for Middle White pigs can be found in a number of villages, and in Selangor a more ambitious experiment and extension station has been established at Sungei Buloh. Flocks of pure breeds of poultry and ducks have been established on a five acre station which will also be used for fruit work and experiments on Chinese market gardening. Fish ponds have been made and stocked with Tilapia which are fed from some of the refuse from the pig pens. Other States and Settlements are now planning to establish similar agricultural stations in new villages.

General.

In Selangor a two weeks' course on agriculture for ketuas was held at Cheras Agricultural Station where a special hostel has been built

by R.I.D.A. The course was a success and a second hostel is being built to provide more accommodation for future courses. In Perak a tractor course was held at Degong and attended by 22 learners.

During the period under review, lectures were given by officers of the Department at the Training School for Assistant Resettlement Officers at Taiping. Lectures was also given on agriculture in schools, outside mosques and other centres, and use of the mobile public address vans of the Department of Information was made in the various States and Settlements.

The new quarterly newsletter of the Department of Agriculture, Kedah and Perlis, is creating a wider circle of readers, and the 3rd edition, issued during the quarter, was increased from 2,500 to 5,000 copies.

Review

STATISTICS FOR COLONIAL AGRICULTURE.

Report on the Organisation of Recording and Estimating.

By K. E. Hunt, Colonial Research Publications No. 11.

H.M.S.O., London, March, 1952. Pp.viii + 84. Price 7s. 6d.

The author, a member of the Agricultural Economics Research Institute of the University of Oxford, has prepared this report for those directly responsible for, or engaged in the practical work of collecting data. He has drawn on a large amount of material describing conditions encountered and methods used in the Colonies, to combine with his own specialist knowledge of techniques and methods. The report provides an adequate description of the whole process of recording and abstracting for the execution of an investigation, and also for those engaged in any one stage of the process who necessarily require a picture of how that one stage integrates with the whole.

The first section, the introduction, outlines a suggested set of statistics and gives briefly the main economic points for compiling them. The succeeding sections deal with the various stages in a programme, proposed in the introduction, by indicating the main features of each stage and giving techniques for surmounting some examples of difficulties encountered. These examples are mainly drawn from the African colonies and it appears that some of the fundamental features of undeveloped areas which call for special treatment are not present in Malaya.

The proposed programme formulates intensive village surveys to gain experience in organising and recording and more detailed knowledge of the economic structure of the country's agriculture, followed by more extensive regional or national surveys utilising the experience and knowledge acquired. This programme can only be modified when either the investigation does not demand, by nature of the data collected, trained or experienced field workers, or experience has already been acquired by available officers.

Some of the problems mentioned could be overcome, it is felt, by laying greater stress on the importance of disseminating the reasons for carrying out a survey, amongst the people directly or indirectly covered by the survey. This would ensure the survey was fully efficient in collecting sensible information from respondents.

A developing agricultural economy requires an information service to ascertain the needs for, and to apply the results of, research: this report outlines a method of setting up such a service applicable to, and easily modified for, a wide range of conditions.

I.W.

The death is recorded, with deep regret, of Mr. Chuah Eng Chan, Agricultural Assistant, Raub, who was murdered by terrorists at Sungei Ruan, near Raub, on the 23rd October, 1952.

Mr. Chuah Eng Chan served as Temporary Chinese Agricultural Assistant, Taiping, under the British Military Administration from October, 1945, to April, 1946. He returned to the College of Agriculture, Malaya, to complete his training, and joined the Department in September, 1946, since when all his service was spent in Pahang. As Chinese Agricultural Assistant, Pahang West, his main duty was to develop and improve the conditions of Chinese agriculture in that area. He devoted himself to the improvement of conditions in the New Villages, working often under difficult conditions and at considerable personal risk. He was on inspection duty near one of the New Villages when he was killed.

Mr. Chuah was one of the most capable of our post-war recruits. He was very keen on his work, he possessed a considerable knowledge of the agriculture of his area, and his approach to the cultivator was excellent. He was held in high regard by all communities in Raub where he was noted for his sincerity and for his devotion to his work. They, with the Chinese cultivators whom he served, will join his colleagues in the Department in regretting his passing.

Promotion.

The Right Honourable the Secretary of State for the Colonies has approved the promotion of Mr. J. R. Curry, Senior Agricultural Officer, to be Chief Field Officer, with effect from the 29th February, 1952.

Appointments.

The Right Honourable the Secretary of State for the Colonies has appointed the following officers to the Malayan Agricultural Service:—

Mr. J. S. Ure to be an Agricultural Officer, with effect from the 1st August, 1952. Mr. Ure is attached to the Federal Experiment Station, Serdang, Selangor.

Mr. P. Class to be an Agricultural Officer, with effect from the 1st August, 1952. Mr. Class is stationed in Johore.

Mr. T. R. Dickinson to be an Agricultural Officer, with effect from the 1st August, 1952. Mr. Dickinson is stationed in Perak.

Mr. P. A. Gething, Agricultural Officer, has been appointed to act as State Agricultural Officer, Pahang, with effect from the 18th August, 1952.

Mr. Cheang Kok Choy, Horticultural Assistant, to act as Horticultural Officer, with effect from 20th September, 1952.

Transfers.

Mr. G. S. Keeping, Agricultural Officer, has been transferred to the post of State Agricultural Officer, Negri Sembilan, with effect from the 11th September, 1952.

Leave.

The following officers have returned from leave:—

Mr. R. Henderson, M.C., Agricultural Officer, on the 3rd August, 1952. Mr. Henderson has been appointed Agronomist-in-Charge, Federal Experiment Station, Serdang, Selangor.

Mr. J. R. Curry, Chief Field Officer, on the 14th September, 1952.

Mr. J. Cook, Senior Agricultural Officer, on the 15th September, 1952. Mr. Cook has been appointed State Agricultural Officer, Kedah and Perlis.

The following officers have proceeded on leave:—

Mr. H. M. James, M.C., Agricultural Officer, with effect from the 19th August, 1952.

Mr. H. Ritchings, Horticultural Officer, with effect from the 19th September, 1952.

MARKET PRICES

July to September, 1952.

Rubber.—July, 1952, commenced with the Singapore price of No. 1 R.S.S., f.o.b., in bales, at 90½ cents per lb. but by the 10th of the month the price had dropped to 85½ cents. It reached 90¼ cents on the 16th July but from then until the end of the month it fluctuated between 87 and 89 cents. The average price for July was 88.24 cents.

The price on the 1st August was 88 cents per lb. and fluctuated between 86⅜ and 87½ cents during the first three weeks of the month but had dropped to 78¼ by the 30th August. The average price for the month was 84.81 cents.

After rising to 79½ cents on the 3rd September, the price of No. 1 R.S.S. was down to 73⅞ cents by the 12th of the month and then ranged between 74 and 76½ during the remainder of the month, to give the low average price of 76.11 cents per lb.

The average prices paid for smallholders' rubber at three centres in the Federation of Malaya during the period July to September, 1952, are given in Table I.

Table I.

Average Monthly Prices Paid by Local Dealers for Smallholders' Rubber, July to September, 1952.

(Dollars per picul of 133 1/3 lbs.)

Grades.	Taiping, Perak.			Seremban, Negri Sembilan.			Batu Pahat, Johore.		
	July	Aug.	Sept.	July	Aug.	Sept.	July	Aug.	Sept.
Smoked Sheet	95.31	92.78	81.55	96.86	91.85	82.92	—	—	—
Unsmoked Sheet	72.72	67.42	55.57	72.85	70.08	61.52	72.07	70.33	63.52
Scrap	38.81	36.40	32.18	37.38	36.71	32.12	25.00	19.50	20.00

This Table has been compiled from statistics supplied by the Registrar of Statistics, Federation of Malaya.

Tea.—The average price paid in Colombo for 23,000 lbs. of Malayan tea, as quoted in the Colombo Brokers' Association weekly report dated the 16th September, 1952, was Rs. 1.02 per lb. The average prices quoted for Ceylon teas were as follows, in rupees per lb.: High Grown Teas 2.31, Medium Grown Teas 1.87, Low Grown Teas 1.61.

Ceylon teas are subject to an export duty but non-Ceylon teas sold at auctions ex-bond in Colombo are not subject to this duty.

In a Return published by the Acting Registrar of Statistics, production of made tea in the Federation of Malaya, as declared by estates, during the period April to June, 1952, was given as 1,037,554 lbs. green and 25,196 lbs. black tea.

The retail price for Malayan tea (Boh) continues to be $2.60 per lb.

Derris.—The average price of derris, as quoted in the weekly reports of the Singapore Chamber of Commerce, ranged from $140 to $150 per picul during July, $130 to $150 during August, and was steady at $140 during September.

Tobacco.—The average prices per picul of cured leaf in Kelantan during July were as follows:—1st Grade $700, 2nd Grade $400, 3rd Grade $175. Prices were not quoted in August and September.

Rice.—The ration of rice remains at 3½ katis per person per week. The range of retail prices, in cents per kati, of the four grades of rice are as follows:—Best Siamese Grade 38 to 40, High Grade 32 to 36, Medium Grade 26 to 32 and Low Grade 19 to 21.

Table II.

Singapore Prices of Various Agricultural Products.

(Dollars per picul)

Date	Copra, Sundried	Coconut oil*	Pepper, F.A.Q. Muntok white	Pepper, Gen. Muntok white	Gambier, Cube	Sago Flour, Lingga	Tapioca Flour No. 1	Oilcake, Round
1952								
7th July -	27.00	43.50	570.00	580.00	70.00	15.75	35.00	17.50
14th July -	26.25	42.50	585.00	595.00	71.00	15.75	35.00	17.50
21st July -	25.75	41.00	570.00	580.00	71.00	16.50	40.50	17.50
28th July -	24.50	40.00	560.00	570.00	70.00	16.50	36.00	17.50
5th Aug. -	24.50	39.50	570.00	580.00	70.00	17.00	35.00	17.25
11th Aug. -	23.00	38.00	575.00	585.00	70.00	17.00	34.00	17.00
18th Aug. -	23.50	38.50	580.00	590.00	70.00	18.50	34.00	17.50
25th Aug. -	24.50	40.75	580.00	590.00	70.00	19.50	34.00	18.00
2nd Sept. -	25.25	41.50	590.00	600.00	70.00	19.50	34.00	18.50
8th Sept. -	25.00	40.25	605.00	615.00	70.00	18.50	35.00	17.50
15th Sept. -	25.00	40.50	605.00	615.00	70.00	17.00	35.00	17.50
22nd Sept. -	26.50	44.00	610.00	620.00	72.00	17.00	34.00	17.50
29th Sept. -	29.00	47.00	600.00	610.00	70.00	17.50	34.50	18.00

* F.O.B.

The above prices are taken from the weekly reports of the Singapore Chamber of Commerce.

FEDERATION OF MALAYA
PRODUCTION OF PALM OIL AND KERNELS.
(In long tons as declared by Estates)

Month	Palm Oil		Palm Kernels	
	1951	1952	1951	1952
January	4,068	3,182	997	839
February	3,510	3,110	813	850
March	3,821	3,327	940	865
April	3,732	3,350	896	893
May	4,260	3,076	1,029	793
June	3,295	3,020	801	718
July	3,249	3,988	781	959
August	3,913	3,819	946	931
September	4,614	4,044	1,125	983
October	4,854		1,172	
November	4,495		1,151	
December	4,463		1,120	
Total	48,274	(30,916)	11,771	(7,831)

In September, 44 estates (planted area 93,035 acres) were in production out of a total of 52 oil palm estates (planted area 97,503 acres).

MALAYAN AGRICULTURAL EXPORTS,
APRIL - JUNE, 1952.

Product	Net Exports in Tons.			
	Year 1950	Year 1951	Apr.-June, 1951	Apr.-June, 1952
Arecanuts	14,867	13,547	2,855	2,807
Coconuts, fresh †‡	36,917 †	32,540 †	4,167 †	19,825 †
Coconut oil ‡	56,045	68,139	15,987	15,030
Copra ‡	4,778	10,878 *	4,165	11,147 *
Copra cake	31,105 *	37,891 *	8,703 *	18,978 *
Gambier, all kinds	331	36	70	20 *
Palm Kernels	9,070	11,809	3,007	2,440
Palm Oil	50,638	45,022	9,444	10,284
Pineapples, canned	14,666	16,859	6,807	2,960
Rubber ¶	692,585 ¶	603,880 ¶	143,465 ¶	137,882 ¶
Sago,—flour	12,006	28,044	8,444	6,082
„ —pearl	1,665	3,401	856	1,249
„ —raw	15,693 *	27,603 *	6,585 *	4,920 *
Tapioca,—flake	1,098	462	251	7
„ —flour	2,782 *	4,475 *	870 *	1,380 *
„ —pearl	13,507	10,230	3,759	1,680
Derris	44	56	20	2
‡ Copra equivalent	96,589	100,499	30,077	13,673

¶ production (Federation of Malaya). † hundreds in number. * net imports.

FEDERATION OF MALAYA RUBBER PRODUCTION.

(In long tons, dry weight)

Month	Estates		Smallholdings (Estimated)		Total	
	1951	1952	1951	1952	1951	1952
January	29,482	27,044	26,588	23,770	56,070	50,814
February	26,519	24,007	22,468	19,200	48,987	43,207
March	30,591	25,679	28,000	20,810	58,591	46,489
April	24,470	25,533	22,005	19,065	46,475	44,598
May	24,227	27,362	20,124	18,346	44,351	45,708
June	28,141	27,243	24,498	20,333	52,639	47,576
July	27,286	29,473	21,097	20,299	48,383	49,772
August	27,330	28,301	24,500	22,052	51,830	50,353
September	26,293	28,690	20,733	20,005	47,026	48,695
October	27,622		22,509		50,131	
November	26,690		20,502		47,192	
December	29,305		22,900		52,205	
Total	327,956	(243,332)	275,924	(183,880)	603,880	(427,212)
Total 1950	375,853		316,732		692,585	

This Table has been compiled from statistics published by the Registrar of Statistics, Federation of Malaya.

Smallholding production is estimated from purchases reported by dealers.

FEDERATION OF MALAYA RICE STATISTICS.

Summary of Acreages and Production, Season 1951—1952.

State or Settlement (1)	TOTAL WET AND DRY PADI									
	Area Planted (2)		Area Destroyed (3)		Area Harvested (4)		Yield of Padi (5)		Rice Production (6)	
	acres	per cent. of total	acres	per cent. of (2)	acres	per cent. of (2)	gantangs (000's)	per cent. of total	tons	per cent. of total
Perlis	48,290	5.8	5,020	10.4	43,270	89.6	12,253	5.7	19,280	5.7
Kedah	282,850	34.3	3,230	1.1	279,620	98.9	97,440	45.3	153,460	45.3
Kelantan	169,490	20.5	2,010	1.2	167,480	98.8	34,830	16.2	54,850	16.2
Trengganu	54,850	6.6	1,240	2.3	53,610	97.7	10,652	5.0	16.780	5.0
Penang & P. Wellesley	38,930	4.7	1,360	3.5	37,570	96.5	9,353	4.3	14,730	4.3
Perak	97,000	11.8	2,330	2.4	94,670	97.6	18,995	8.8	29,910	8.8
Selangor	48,290	5.9	1,170	2.4	47,120	97.6	16,445	7.6	25,890	7.6
Pahang	26,370	3.2	760	2.9	25,610	97.1	5,381	2.5	8,470	2.5
Negri Sembilan	27,790	3.4	4,210	15.2	23,580	84.8	5,502	2.6	8,660	2.6
Malacca	29,550	3.6	9,890	33.5	19,660	66.5	4,019	1.9	6,330	1.9
Johore	1,410	.2	390	27.7	1,020	72.3	118	.1	190	.1
Total	824,820	—	31,610	3.8	793,210	96.2	214,988	—	338,550	—
Off-Season Crop	6,230	—	20	.3	6,210	99.7	1,564	—	2,470	—
Total 1951-52	831,050	—	31,630	3.8	799,420	96.2	216,552	—	341,020	—
Total 1950-51	875,390	—	10,770	1.2	864,620	98.8	281,169	—	442,780	—

Acreages to nearest 10 acres.
Rice production to nearest 10 tons.
Conversion Rate: 635 gantangs of padi = 1 ton of rice (i.e. milling recovery = 63 per cent.)

FEDERATION OF MALAYA RICE STATISTICS.

Summary of Acreages and Production—Season 1950-1951.

Wet Padi.

State or Settlement (1)	Area Planted (2)		Area Destroyed (3)		Area Harvested (4)		Average Yield per Acre				Yield of Padi (7)		Rice Production (8)		Remarks (9)
							Padi (5)		Rice (6)						
	acres	per cent. of total	acres	per cent. of (2)	acres	per cent. of (2)	gantangs	per cent of av. for season	lbs.	per cent of av. for season	gantangs (000's)	per cent. of total	tons	per cent. of total	
Perlis -	48,010	5.9	—	—	48,010	100.0	394	117.6	1,391	117.6	18,928	7.0	29,810	7.0	
Kedah -	281,640	34.3	110	—	281,530	100.0	419	125.1	1,479	125.1	118,081	43.5	185,950	43.5	
Kelantan -	136,960	16.7	690	.5	136,270	99.5	281	83.9	992	83.9	38,478	14.2	60,600	14.2	340 acres abandoned due to late planting; 350 acres destroyed by floods and sea water.
Trengganu -	47,980	5.8	—	—	47,980	100.0	258	77.0	911	77.0	12,386	4.6	19,510	4.6	
Penang and P. Wellesley -	39,520	4.8	40	.1	39,480	99.9	269	80.3	950	80.3	10,613	4.0	16,710	4.0	
Perak -	102,710	12.5	2,520	2.5	100,190	97.5	288	86.0	1,017	86.0	28,901	10.6	45,510	10.6	1,470 acres abandoned due to high price of rubber; 750 acres abandoned due to resettlement of cultivators; 300 acres destroyed due to lack of water.
Selangor -	50,060	6.1	280	.6	49,780	99.4	313	93.4	1,105	93.4	15,600	5.7	24,570	5.7	280 acres abandoned due to lodging.
Pahang -	40,740	5.0	590	1.4	40,150	98.6	252	75.2	890	75.2	10,105	3.7	15,910	3.7	590 acres abandoned due to damage by flood, wild animals and birds.
Negri Sembilan -	31,600	3.9	490	1.6	31,110	98.4	299	89.2	1,055	89.2	9,306	3.4	14,660	3.4	440 acres abandoned due to damage by pests & floods; 50 acres abandoned due to resettlement of cultivators.
Malacca -	31,980	3.9	3,380	10.6	28,600	89.4	280	83.6	988	83.6	7,997	2.9	12,590	2.9	2,570 acres abandoned because of empty grains; 370 acres abandoned due to damage by flood and sea water; 440 acres abandoned due to damage by pests and disease.
Johore -	9,290	1.1	2,100	22.6	7,190	77.4	157	46.9	554	46.9	1,127	.4	1,770	.4	1,420 acres abandoned because of floods; 600 acres destroyed by pests and disease; 80 acres abandoned due to drought at flowering stage.
Total -	820,490	—	10,200	1.2	810,290	98.8	335	—	1,183	—	271,522	—	427,590	—	
Off-Season Crop	8,100	—	90	1.1	8,010	98.9	293	—	1,034	—	2,345	—	3,690	—	
Total 1950-51 -	828,590	—	10,290	1.2	818,300	98.8	335	—	1,183	—	273,867	—	431,280	—	
Total 1949-50 -	871,470	—	19,850	2.3	851,620	97.7	314	—	1,108	—	266,994	—	420,460	—	

Acreage to nearest 10 acres.
Rice production to nearest 10 tons.
Conversion Rate: 635 gantangs padi = 1 ton rice (i.e. milling recovery = 63 per cent.).

FEDERATION OF MALAYA RICE STATISTICS.

Summary of Acreages and Production—Season 1950-1951.

Dry Padi.

State or Settlement (1)	Area Planted (2)		Area Destroyed (3)		Area Harvested (4)		Average Yield per Acre				Yield of Padi (7)		Rice Production (8)		Remarks (9)
							Padi (5)		Rice (6)						
	acres	per cent. of total	acres	per cent. of (2)	acres	per cent. of (2)	gantangs	per cent of av. for season	lbs.	per cent of av. for season	gantangs (000's)	per cent. of total	tons	per cent. of total	
Perlis	40	.1	—	—	40	100.0	228	144.3	805	144.3	9	.1	10	.1	
Kedah	3,580	7.7	—	—	3,580	100.0	166	105.1	586	105.1	595	8.2	940	8.2	
Kelantan	28,930	62.4	—	—	28,930	100.0	160	101.3	565	101.3	4,639	64.2	7,310	64.2	
Trengganu	9,840	21.2	—	—	9,840	100.0	150	94.9	530	94.9	1,472	20.4	2,320	20.4	
Penang and P. Wellesley	280	.6	—	—	280	100.0	189	119.6	667	119.6	53	.7	80	.7	
Perak	2,540	5.4	380	15.0	2,160	85.0	147	93.0	519	93.0	318	4.4	500	4.4	250 acres bore no grain due to late planting. 130 acres abandoned due to attack by pests, and to neglect.
Selangor	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Pahang	790	1.7	—	—	790	100.0	158	100.0	558	100.0	125	1.7	200	1.7	
Negri Sembilan	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Malacca	40	1	—	—	40	100.0	237	150.0	837	150.0	9	.1	10	.1	
Johore	350	.8	100	28.7	250	71.3	52	32.9	184	32.9	13	.2	20	.2	50 acres destroyed by floods; 50 acres destroyed by pests.
Total	46,390	—	480	1.0	45,910	99.0	158	—	558	—	7,233	—	11,390	—	
Off-Season Crop	410	—	—	—	410	100.0	170	—	600	—	69	—	110	—	
Total 1950-51	46,800	—	480	1.0	46,320	99.0	158	—	558	—	7,302	—	11,500	—	
Total 1949-50	59,060	—	350	.6	58,710	99.4	166	—	586	—	9,770	—	15,380	—	

Acreage to nearest 10 acres.
Rice production to nearest 10 tons.
Conversion Rate: 635 gantangs padi = 1 ton rice (i.e. milling recovery = 63 per cent.).

FEDERATION OF MALAYA RICE STATISTICS.

Summary of Acreages and Production, Season 1951—1952.

Wet Padi

State or Settlement (1)	Area Planted (2)		Area Destroyed (3)		Area Harvested (4)		Average Yield Per Acre				Yield of Padi (7)		Rice Production (8)		Remarks (9)
							Padi (5)		Rice (6)						
	acres	per cent. of total	acres	per cent. of (2)	acres	per cent. of (2)	gant-angs	per cent. of av.for season	lbs.	per cent. of av.for season	gant-angs (000's)	per cent. of total	tons	per cent. of total	
Perlis	48,200	6.1	5,020	10.4	43,180	89.6	283	102.1	996	102.1	12,238	5.8	19,260	5.8	5,020 acres damaged by drought.
Kedah	280,480	35.8	3,230	1.2	277.250	98.8	350	126.3	1,232	126.3	97,015	46.5	152,790	46.5	3,230 acres damaged by drought, late planting, floods, pests and diseases.
Kelantan	140,970	18.0	1,930	1.4	139,040	98.6	219	79.1	771	79.1	30,468	14.6	47,980	14.6	1,930 acres abandoned owing to drought.
Trengganu	46,700	5.9	1,240	2.7	45,460	97.3	207	74.8	729	74.8	9,423	4.5	14,840	4.5	1,240 acres failed to yield grain.
Penang & P. Wellesley	38,870	5.0	1,360	3.5	37,510	96.5	249	89.8	876	89.8	9,347	4.5	14,720	4.5	1,360 acres abandoned owing to Leptocorisa damage and late planting.
Perak	96,550	12.3	2,310	2.4	94,240	97.6	201	72.6	708	72.6	18,930	9.1	29,810	9.1	2,310 acres not harvested owing to empty ears, bird damage, late planting and resettlement of squatters.
Selangor	48,290	6.2	1,170	2.4	47,120	97.6	349	126.0	1,228	126.0	16,445	7.9	25,890	7.9	1,170 acres not harvested owing to empty grains and floods.
Pahang	25,360	3.2	760	3.0	24,600	97.0	213	76.9	750	76.9	5,246	2.5	8,260	2.5	760 acres damaged by rats.
Negri Sembilan	27,760	3.5	4,180	15.1	23,580	84.9	233	84.1	820	84.1	5,502	2.6	8,660	2.6	4,180 acres not harvested owing to empty grains, pests and diseases.
Malacca	29,550	3.8	9,890	33.5	19,660	66.5	204	73.6	718	73.6	4,019	1.9	6,330	1.9	9,890 acres not harvested owing to empty grains, pests and diseases.
Johore	1,410	.2	390	27.7	1,020	72.3	115	41.5	405	41.5	118	.1	190	.1	250 acres failed to yield due to pest damaged and flood: 140 acres were abandoned by cultivators.
Total	784,140	—	31,480	4.0	752,660	96.0	277	—	975	—	208,751	—	328,730	—	
Off-Season Crop	5,970	—	20	.3	5,950	99.7	258	—	908	—	1,534	—	2,420	—	
Total 1951-52	790,110	—	31,500	4.0	758,610	96.0	277	—	975	—	210,285	—	331,150	—	
Total 1950-51	828,590	—	10,290	1.2	818.300	98.8	335	—	1,183	—	273,867	—	431,280	—	

Acreages to nearest 10 acres.
Rice production to nearest 10 tons.
Conversion Rate: 635 gantangs of padi = 1 ton of rice (i.e. milling recovery = 63 per cent.)

FEDERATION OF MALAYA RICE STATISTICS.

Summary of Acreages and Production, Season 1951—1952.

Dry Padi

State or Settlement (1)	Area Planted (2)		Area Destroyed (3)		Area Harvested (4)		Average Yield Per Acre				Yield of Padi (7)		Rice Production (8)		Remarks (9)
							Padi (5)		Rice (6)						
	acres	per cent. of total	acres	per cent. of (2)	acres	per cent. of (2)	gantangs	per cent. of av. for season	lbs.	per cent. of av. for season	gantangs (000's)	per cent. of total	tons	per cent. of total	
Perlis	90	.2	—	—	90	100.0	168	109.0	591	109.0	15	.2	20	.2	
Kedah	2,370	5.8	—	—	2,370	100.0	179	116.2	630	116.2	425	6.8	670	6.8	
Kelantan	28,520	70.1	80	.3	28,440	99.7	153	99.4	538	99.4	4,362	70.0	6,870	70.0	80 acres of padi failed to set grain due to adverse weather conditions.
Trengganu	8,150	20.0	—	—	8,150	100.0	151	98.0	531	98.0	1,229	19.7	1,940	19.7	
Penang & P. Wellesley	60	.1	—	—	60	100.0	98	63.6	345	63.6	6	.1	10	.1	
Perak	450	1.2	20	4.4	430	95.6	151	98.0	531	98.0	65	1.1	100	1.1	20 acres destroyed by birds.
Selangor	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Pahang	1,010	2.5	—	—	1,010	100.0	133	86.4	468	86.4	135	2.1	210	2.1	
Negri Sembilan	30	.1	30	100.0	—	—	—	—	—	—	—	—	—	—	25 acres abandoned due to the Emergency and 5 acres destroyed by pests.
Malacca	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Johore	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Total	40,680	—	130	.3	40,550	99.7	154	—	542	—	6,237	—	9,820	—	
Off-Season Crop	260	—	—	—	260	100.0	115	—	405	—	30	—	50	—	
Total 1951-52	40,940	—	130	.3	40,810	99.7	154	—	542	—	6,267	—	9,870	—	
Total 1950-51	46,800	—	480	1.0	46,320	99.0	158	—	558	—	7,302	—	11,500	—	

Acreages to nearest 10 acres.

Rice production to nearest 10 tons.

Conversion Rate: 635 gantangs of padi = 1 ton of rice (i.e. milling recovery = 63 per cent.)

FEDERATION OF MALAYA

PRODUCTION OF COPRA, COCONUT OIL AND COPRA CAKE.

(in tons)

Month	Copra Production						Coconut Oil Production		Copra Cake (Poonac) Manufactured	
	Estates		Smallholdings (estimated)		Total		Oil Mills		Oil Mills	
	1951	1952	1951	1952	1951	1952	1951	1952	1951	1952
January	2,346	2,740	8,501	9,296	10,847	12,036	5,537	6,681	3,532	4,244
February	2,516	2,777	6,323	8,510	8,839	11,287	4,856	6,338	3,072	4,016
March	3,059	2,864	9,078	8,522	12,137	11,386	5,752	5,616	3,784	3,647
April	2,888	2,964	7,832	8,684	10,720	11,648	5,714	6,128	3,585	3,949
May	3,200	3,279	10,764	8,560	13,964	11,839	6,718	5,797	4,342	3,820
June	3,692	3,643	9,518	7,642	13,210	11,285	7,287	6,067	4,716	3,960
July	4,083	3,846	11,580	11,294	15,663	15,140	8,571	7,177	5,567	4,075
August	4,044	4,151	11,756	10,357	15,800	14,508	8,552	7,645	5,569	4,902
September	3,777	3,848	10,551	12,426	14,328	16,274	7,833	8,292	5,043	5,014
October	3,402		12,186		15,588		8,543		5,570	
November	3,245		10,392		13,637		8,491		5,456	
December	3,170		12,139		15,309		8,543		5,425	
Total	39,422	(30,112)	120,620	(85,291)	160,042	(115,403)	86,397	(59,741)	55,661	(37,627)

Notes:—1. The above statistics are compiled and published by the Registrar of Statistics, Federation of Malaya.

2. Estate copra production and coconut oil production are as declared by estates and oil mills respectively.

3. Statistics of smallholding coconut oil production are not available.

4. Smallholding copra production for commercial purposes is estimated from the formula: imports + estate stocks (opening) + estate production + smallholding production = exports + local oil mill consumption + estate stocks (closing).

METEOROLOGICAL SUMMARY, MALAYA, AUGUST, 1952.

Locality	Air Temperature degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes						Total		Most in a day	Number of days					Total	Daily Mean	Per cent.
	A. Max.	B. Min.	Means of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot °F	At 4 feet °F			Amt.	Precipitation .01 in or more	Precipitation .04 in or more	Thunderstorm	Fog morning obsd.	Gale force 8 or more			
										ins.	m m.	ins.						hrs.	hrs.	
Ipoh, Perak	91.0	71.6	81.3	94.8	68.2	84.5	74.4			5.12	130.0	1.62	11	10	4		2	181.65	5.86	
Port Swettenham, Selangor	89.2	72.2	80.7	91.8	69.8	82.8	74.8	84.5	85.4	6.16	156.5	1.65	13	9	2			195.35	6.30	
Kuala Lumpur, Selangor	89.8	72.3	81.1	93.0	68.9	84.2	75.0			4.50	114.3	1.96	10	9	4	1				
Sitiawan, Perak	90.3	72.3	81.3	92.8	69.8	86.2	75.0	84.9	86.1	5.10	129.5	2.89	9	7	2			185.75	5.99	
Kuala Lipis, Pahang																				
Kuantan, Pahang	89.3	71.7	80.5	92.3	68.3	82.1	75.1			9.14	232.2	2.56	18	14	3	5		207.80	6.70	
Temerloh, Pahang																				
Bayan Lepas, Penang	87.1	74.0	80.5	90.1	70.2	81.4	77.0			8.55	217.2	2.08	14	14				186.50	6.02	
Malacca		72.8			69.2		77.8			12.89	327.4	3.29	16	13	6		2	183.05	5.90	
Mersing, Johore	87.1	71.5	79.3	89.6	67.6	80.2	73.6			6.65	168.9	1.79	16	12	4			194.80	6.28	
Alor Star, Kedah	87.5	73.3	80.4	89.9	71.4	82.9	75.4			4.08	103.6	1.03	16	13				166.15	5.36	
Kota Bharu, Kelantan	87.6	73.7	80.7	90.2	71.6	84.0	76.1	85.2		8.09	205.5	1.91	19	13	9	2		179.00	5.77	
K. Trengganu, Trengganu	86.8	72.3	79.5	88.9	69.1	81.4	75.1			6.83	173.5	1.72	16	12	6			181.45	5.85	
Kallang Aerodrome (S'pore)	86.1	75.2	80.7	89.0	71.7	82.0	79.5			12.89	327.4	3.40	16	13	5		3	176.90	5.71	
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft.	73.9	62.0	67.9	78.2	59.8	70.2	63.9	71.9	72.7	3.08	78.2	0.87	13	13		12		167.85	5.41	
Cameron Highlands, Tanah Rata, Pahang 4750 ft.																				

Compiled from Returns supplied by the Malayan Meteorological Service.

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